What's in this issue-

Broaching recently has gone far afield in solving difficult production problems, has resulted in development of new and better engineering

HARRY A. GOTBERG

designs, permits specification of closer tolerances. Harry H. Gotberg, in charge of broach and fixture design for Colonial Broach Co., relates the **details of specific broaching operations (with drawings)** on page 159.

Low cost and high accuracy recommend the **shop microscope as a tool for laying out small jigs.** C. C. Street, chief engineer of Federal Products Corporation, tells you on page 183 how to do the job.

Do you know that **deep corrugations on the wall of a deep-drawn steel shell can be made faster by rolling than by spinning?** See page 168 for instructions, with diagrams.

Ventilation of welding booths is a problem which management must handle, now that welding has come into its own. On page 173 is an account of how a controlled air current will carry away fumes and curtail the silica count behind the welder's mask when coated rods are used.

A number of **typical cutter grinding set-ups** are shown, with pictures and long captions, on page 176.

What is carbide's place in finishing steel parts? Carl Pulvermacher, experimental engineer of Ex-Cell-O Corporation, says on page 166 that carbide tools may be used successfully in precise sizing if the user ignores precedent and concentrates on his particular needs. Photographs illustrate his point.

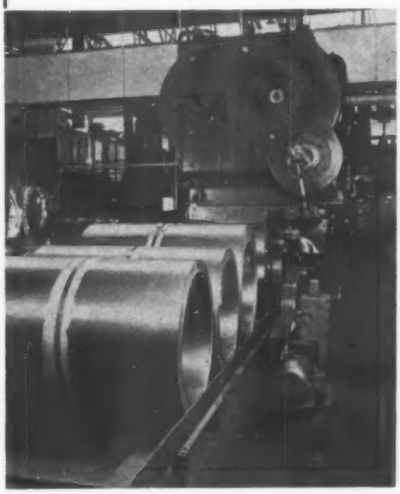
The same chip breaker is not applicable to all turning and boring jobs. Each set of conditions must be considered separately. The final article on **current practice in chip control** presents the experience of Potter & Johnston, Sundstrand Machine Tool, R. K. LeBlond Machine Tool, Gisholt Machine, and the Lynn and Schenectady works of General Electric. See page 178.

Cutting stamina of small tools depends to an important degree upon proper metallurgical control. Dr. William R. Frazer, chief metallurgist of Union Twist Drill Co., describes his company's system of metallurgical control of its products. Page 170.

How United Aircraft makes Hamilton controllable pitch propellers

is told in a series of three picture-articles, the first of which is on page 162. **Machining of the forged aluminum alloy blade** is described.

COMING



In the next issue

Continuous feeding of coils of sheet steel into stamping presses is not a fad, but a practical measure for saving money in the press shop. It makes possible the staggering of dies in the press in such manner as to reduce wastage in each blanking operation to a minimum. Coils of wide sheet for this work are obtained by welding together two to four shorter coils. Such arrangement not only eliminates much scrap at the ends of sheets when used singly, but also reduces the time lost in handling or feeding into the press. To make possible the use of large coils, sheets are butt-welded before pickling. In the March 23 issue you will find a complete description of how one of the country's biggest manufactures does all of this. You may be able to adapt some of the ideas to your own requirements.

There will be other tempting articles in the next issue. What shop modernization has done for the Boyar-Schultz Co. at Chicago will be told with a number of pictures so that you can visualize it readily. At the last moment this article, originally scheduled for the present issue, had to be held over. Then the second article about the manufacture of the Hamilton controllable pitch propeller will be of interest, with pictures predominating. Other articles: on wage payment methods, metal finishing and drill jigs.

In later issues

Gun carriage parts are being assembled by the acetone dry ice method, the trunnion extension being shrunk to the cradle by that method. Detailed data on this subject, accompanied by excellent pictures, will be published in an early issue.

THE abusive battering inflicted by pneumatic hammers on chisels, rivet sets, beading and similar tools taxes tool steels to the utmost. That's the kind of service Bethlehem Omega Tool Steel thrives under—the punishment this remarkable tool steel is specially made to take.

An unusual combination of physical properties makes Omega super-shock-resistant and well-equipped to handle the toughest, roughest jobs of all. When Omega is quenched in oil at 1600 deg. F., and tempered at 400 deg. F., a Rockwell hardness of C59 is obtained in combination with a tensile strength of 340,000 lbs. per sq. in. Tempering at slightly higher temperatures further increases toughness, with only a slight reduction in impact resistance. Excellent results are also obtained by quenching Omega in water.

As Omega responds to an unusually wide temperature range and requires no expensive heat-treating equipment, this tool steel is as well adapted to use in the field as in the shop. The uniformly excellent results being obtained with Omega are typical of all Bethlehem Tool Steels, among which can be found a grade for the efficient handling of every tool steel task.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

AMERICAN MACHINIST

ESTABLISHED 1877

F. H. COLVIN • K. H. CONDIT • BURNHAM FINNEY, Editors

Fundamentals of Recovery

JUST HOW to get the country out of its current befuddlement is the main objective of everyone from President Roosevelt down to the smallest business man. Yet the fact that everyone is concentrating on that objective leads to confusion because hardly ever do two people agree on what should be done.

The White House believes that prices are out of kilter and if a proper balance is restored, the country will be over the hump. A prominent government economist thinks that if housing construction gets under way on a big scale, that in itself will provide the impetus to get business moving again. Members of the so-called "lunatic fringe" who yelled their heads off for inflation back in 1933-35 are again brewing the same patent medicine for Uncle Sam. Some C.I.O. leaders declare an annual wage in industry will restore good times because workers then will be assured of a steady income and will be able to buy more goods. A sizable chorus has rightfully chanted protests against the "tax business" policy of the administration, believing that repeal of injurious tax measures will leave industry free to expand. The Left-Wingers at Washington would like to see further regimentation and socialization of industry.

These conflicting ideas, one pulling against another, are apt to confuse us and to obscure the fundamentals on which industry and the country should build for the future. Those fundamentals are simple and can be reduced to two sentences:

1. Industry should strive to reduce manufacturing costs by using most modern equipment, to pay the highest wage and to sell its products at the lowest prices, thus building up mass purchasing power which will result in the greatest consumption of goods.

2. Industry should do this under the system of private enterprise which has made the United States the most highly industrialized country in the world and which has brought to the masses comforts not enjoyed by workers elsewhere.

IN SUPPORT of these basic principles we have to look no farther than the New Deal itself. Governor Marriner Eccles of the Federal Reserve Board states the case:

"There is only one way in which the general standard of living can rise and that is by an increase in the production and consumption of real goods and services per head of population. This stubborn fact, though incontrovertible, is too often ignored or forgotten. We are inclined to think too much in terms of money incomes and not enough in terms of what the incomes will buy.

"In the final analysis, the national income is measured by the total output of goods. If there is less to divide, all groups of the population, including capital, labor and agriculture, will suffer. The national standard of living will decline. . . . I am hopeful that business men will act upon recognition of the fact that their long-run interests are bound up with the largest possible volume of production at the lowest possible prices."

Gaging Business

BUSINESS in the metal-working industries has about held its own the past fortnight. While some machine tool companies report February a better month than January, the volume leaves much to be desired. Plenty of orders are ready to be placed as soon as buyers are convinced of an upturn. Machinery exports consistently staying 40% above a year ago, are greatly helping operations. Steel mills haven't yet experienced a seasonal rise but look for increased demand later this month. Farm tractor builders are encouraged by sales interest in their new models.

Automobile makers believe the extent of their spring upsurge depends considerably on the industry's ability to break the used car jam. The electric industry is pushing appliance sales to offset losses in industrial power consumption. Vacuum cleaner sales in January were the second highest for that month in history but washing machine sales were off 40% and ironing machines off 43%. Business in plastics is still low, but a pick-up is anticipated. A bright spot is the government's naval program which will mean expenditure of $8,000,000 to prepare shipyards for expanded operations. Business Week's index of business activity is at 57.1 compared with 60.4 two weeks ago. Engineering construction awards well in advance of last year's comparable period are a bullish factor.

CHICAGO—Steel operations continue a slight upward trend. Machinery orders in February were the poorest in months, but inquiries are good. Some equipment dealers have gone so far as to increase sales personnel in an intensive drive to get business. On the bright side is the interest displayed in new tractors such as Caterpillar's small diesel model, John Deere's model G and Allis Chalmers' $495 model which is reported selling in twice the anticipated volume.

NEW ENGLAND—Recent moderate upturn in machinery orders has sagged off and dealers are waiting for revival of governmental purchasing while scouring the market for industrial buyers. Action on naval machinery inquiries awaits appropriations for armament programs. A gain is noted in New Bedford cotton textile circles, and Westinghouse has resumed refrigerator production at Springfield, restoring 900 employees. Shoe output is off 35% and electric power 11%.

PITTSBURGH—Steel operations are staying near 30% but automotive releases are believed near. Stainless steel sales are close to last year's record level partly because of new applications of that metal. Machinery sales are almost non-existent and inquires have declined. Follansee Brothers are running their mills alternate weeks thus giving all employees some work.

DETROIT—February was a better month than January for machinery sales and March should show further gain. Auto die shops, full of contract work, are waiting for releases to go ahead. Tool shops probably won't be busy for 30 to 60 days. The supply trade is a little more active, but still dull. Some Toledo tool shops are booked ahead four to six weeks, but auto parts makers are running at only a small fraction of capacity.

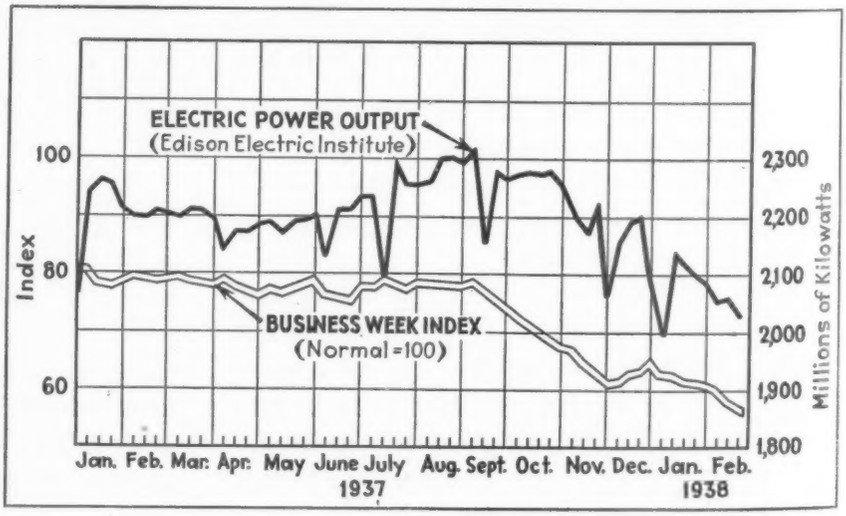
NEW YORK—More orders and better diversification for heavy metal-working equipment are reported. Government works programs in South American countries are responsible for a lively machine export trade. Some of the larger plants in this district are operating on shorter hours than in '32.

CLEVELAND—Machine tool sales in February were slightly above expectations for some companies, but immediate outlook is not good, reflecting consistently discouraging attitude of Washington toward industry.

SAN FRANCISCO—Though far western building construction work is in larger volume than a year ago, indices based on general activities are running considerably behind. Bank debits are off 16% and mechanical and industrial operations are down 7%. The Los Angeles flood disaster is expected to have no effect on equipment buying or on general business outside of the immediate territory affected. Machine tool men cling to forecasts of a summer upturn but have little hope of really good business before fall.

ELECTRIC POWER OUTPUT VS. GENERAL BUSINESS

When the wheels of industry slow down, the watt-hour meter must follow suit. Few indicators parallel the general business trend so closely as does the consumption of electricity



A.S.T.E. Holds First Annual Machine and Tool Exhibition

Forums on surface finishes and equipment purchasing are scheduled for evening sessions at the Society's annual membership convention

FRANK A. SHULER
President, American Society of Tool Engineers

WHILE MANY may have believed the depths of the depression a poor time to start anything, a group of production men, employed in various Detroit plants, laid the foundations for the present American Society of Tool Engineers during that period. These men recognized that readjustments made necessary by recovery inevitably would require more intelligent planning and a better understanding of possibilities inherent in new processes, methods and tools. They believed that a means for exchanging ideas should be established for the mutual benefit of those whose business is the production of goods in large and small quantities. With its first annual membership convention and the coincident Machine and Tool Progress Exhibition, being held in Detroit on March 9-12, the American Society of Tool Engineers really becomes the national institution conceived when the Society was formed in 1932 by the 33 original members.

The purpose of the Society has been set down as: "to advance, promulgate and further the arts of Tool Engineering among the membership of the Society; to bring good fellowship, fraternity and the spirit of brotherhood among the members; to hold readings and discussions on professional papers and reports at meetings called for that purpose; to publish and disseminate such papers and reports to the members . . ."

During the three years that followed the organization meeting, growth of the Society was slow. Production men, as a rule, are not "joiners." In 1935, A.S.T.E. membership, still confined to Detroit, numbered about 400. By the fall of that year, however, requests for information about the organization were received from groups in a number of other cities.

President of A.S.T.E. during 1937, Frank A. Shuler is master mechanic at Chrysler's Highland Park plant. During his administration, the Society has doubled in size; seven additional chapters have been chartered

First of the chapters to be organized outside of Detroit was the Racine Chapter, formed in October, 1935. Cleveland followed in December and Milwaukee in April, 1936. By November, 1937, fourteen chapters had been organized. Rapid as was the Society's growth during 1936, membership and chapters more than doubled during 1937. Three additional chapters are in the process of organization and will have received their charters by the time of the Annual Meeting. These are located in Philadelphia, Pa., Rochester, N. Y. and St. Louis, Mo.

In its set-up, the A.S.T.E. is unusual in that each local chapter is self-sustaining and self-managed. There are 33 directors elected by the membership and including chapter chairmen. The directors, in turn, elect the national officers. This year, in laying plans for the first membership convention of the Society, the Board of Directors decided to stage an exhibition of production equipment for the benefit of members of the Society and other production engineers and executives interested in tool engineering.

Coincident with the show, the technical program for the annual meeting is planned for the benefit of Society members. Forums on technical subjects take the place of the more conventional presentation of technical papers on unrelated subjects. Arrangements have been made for visiting tool engineers to inspect a large number of plants in the Detroit area, ranging from tool and die shops to large, mass-production plants.

The entire program has been timed to precede most major 1938 tooling and equipment programs. As a result, the Society's membership and industry at large is given an opportunity to view recent developments in tools, accessories and equipment before the programs get under way. The Society anticipates that by this means it will contribute something of definite value to American industry. Every tool engineer and production executive is cordially invited to attend the entire program of meetings, trips and exhibition during the four days.

Exhibitors At The Machine and Tool Progress Exhibition

Detroit Convention Hall, March 9-12, 1938

(Booth number follows name of company)

ALLEN MFG. CO., *(272). Socket-head cap-screws, shoulder screws and setscrews, wrench sets.*

AMERCAN EQUIPMENT CO., *(341).*

AMERICAN MACHINIST, *(240).*

AMERICAN SOCIETY OF TOOL ENGINEERS, *(295).*

B. C. AMES CO., *(248). Precision tools and gages, bench lathes.*

APEX MACHINE & TOOL CO., *(231). Chucks and toolholders, nut setters.*

BARBER-COLMAN CO., *(315 and 354). Small tools, cutters, hobs, reamers.*

BARRETT-CRAVENS CO., *(380). Lift trucks, scale trucks, skids and portable elevators.*

JOHN BATH & CO., INC., *(155). Gages and precision tools.*

G. S. BLAKESLEE CO., *(221). Solvent-degreasing machines.*

BOYER-CAMPBELL CO., *(225).*

THE BRISTOL CO., *(365). Control instruments.*

BROWN & SHARPE MFG. CO., *(245). Precision tools, cutters, arbors, adapters, pumps and chucks.*

CHARLES BRUNING CO., *(230).*

BUELL DIE & MACHINE CO., *(370).*

ANDREW C. CAMPBELL DIV., AMERICAN CHAIN & CABLE CO., *(260). Abrasive cut-off machines, nibbling machines.*

CARBOLOY CO., INC., *(229). Standard and special tools, grinding wheel dressers, drawing and extrusion dies.*

CHICAGO PNEUMATIC TOOL CO., *(379). Portable drills, grinders and hammers.*

CHICAGO RIVET & MACHINE CO., *(154).*

COLONIAL BROACH CO., *(243). Broaches.*

CONTINENTAL MACHINE SPECIALTIES, INC., *(337). Contour sawing and filing machines.*

THE CUSHMAN CHUCK CO., *(343). Power chucks, power chuck wrench, precision 2-jaw chuck, standard chucks for various spindles.*

DALRAE TOOLS CO., *(188). High-speed milling, drilling and boring heads.*

DAVIS BORING TOOL DIV., LARKIN PACKER CO., *(357). Boring and facing tools, reamers.*

DAYTON ROGERS MFG. CO., *(317). Universal pneumatic die cushions.*

DELTA MFG. CO., *(228). Drilling, grinding and sawing machines, tapping attachments..*

DETROIT AREA ASSOCIATED MACHINE & TOOL DISTRIBUTORS, *(186).*

DETROIT TAP & TOOL CO., *(244). Taps, chasers, thread gages, thread rolling dies and thread milling hobs.*

THE DETROIT TESTING MACHINE CO., *(187).*

DUPLEX EQUIPMENT CO., *(371).*

ECLIPSE COUNTERBORE CO., *(340). Cutters and tool holders.*

ELECTRONIC CONTROL CORP., *(180).*

ESCO ENGINEERING SERVICE. *(185).*

ETTCO TOOL CO., *(325). Drill chucks, tappers, drill heads.*

EXACT WEIGHT SCALE CO., *(369). Over-and-under-weight scales, shadowgraph scales.*

EX-CELL-O CORP., *(296). Bushings, broaches, counterbores, form tools, milling cutters and precision-machined parts.*

J. N. FAUVER, INC., *(339).*

FEDERAL PRODUCTS CORP., *(344). Dial indicators.*

FORD MOTOR CO., JOHANSSON DIV., *(360). Gage blocks and accessories.*

FOSTORIA PRESSED STEEL CORP., *(249). Lighting fixtures and coolant filters.*

FRICK-GALLAGHER MFG. CO., *(359). Standard and rotary shelving.*

GAIRING TOOL CO., *(309). Inserted blade milling cutters, counterbores, core drills, floating tool holders.*

GENERAL ELECTRIC CO., *(353). Motors and control apparatus.*

GODDARD AND GODDARD CO., INC., *(330). Milling cutters, reamers, combination boring, facing and chamfering tools.*

GOODSPEED-DETROIT CO., *(364). Speed lathes, drill press, cutter grinder, drill chucks, mandrels, wheel dressers, reamers, and mills, live centers, flexible metal hose, welded steel equipment.*

GORHAM TOOL CO., *(300). Milling cutters, slitting saws, end mills, form tools, tool bits, turning tools, wear-resisting alloy centers and bushings.*

GREENFIELD TAP & DIE CORP., *(253). Taps, dies, drills, reamers, gages, pipe tools, screw extractors and screw plates.*

GRINDING MACHINERY CO., *(347). Coolant pumps, dust collectors, layout plates, demagnetizers, grinders, cut-off machine, gage blocks, comparator.*

GROB BROTHERS, *(268). Open-end and continuous metal band saws, filing machine.*

HAMILTON MFG. CO., *(157).*

HAMILTON TOOL CO., *(368). Sensitive drills, shop tools.*

HANNIFIN MFG. CO., *(298).*

HAYNES STELLITE CO., *(323). Stellite-2400 and J-metal tools, wear strip for boring bars.*

HOLE ENGINEERING SERVICE, *(278). Bearing-izing tools and machines, automatic drilling units, precision hones, portable cylinder grinders, reaming machine, precision boring spindle, portable grinder.*

HOLO-KROME SCREW CORP., *(318). Forged socket-head screws, stripper bolts, setscrews and pipe plugs, wrench sets.*

HYDRAULIC PRESS MFG. CO., *(233). Model 25 plastic injection molding machine.*

ILLINOIS TOOL WORKS, *(333). Milling cutters, hobs, broaches and special tools, gear testing equipment.*

INDEX MACHINERY CORP., *(352). Lester LPM-2 plastic injection molding machine.*

INTERNATIONAL NICKEL CO., *(355). Representative parts made from nickel-alloyed materials.*

JACOBS MANUFACTURING CO., *(320). Standard and single-purpose chucks.*

CHARLES L. JARVIS CO., *(342). Flexible shaft machines and attachments, rotary files, tapping attachments, quick-change chucks and collets, screw driving chucks and machines.*

JENNISON-WRIGHT CO., *(366). Wood-block flooring, oils, paints.*

JIG BUSHING CO., *(252). Jig and tool parts.*

JONES-FORS CO., *(232). Portable drills and grinders, drill and lathe chucks.*

JONES & LAMSON MACHINE CO., *(376).*

H. R. KRUEGER & CO., INC., *(328).*

LEE MACHINERY CORP., *(255). Lathes.*

LELAND GIFFORD CO., *(251). Jig bushings, hardened and ground parts.*

Ford R. Lamb has served as a director, vice-president and president of A.S.T.E. became executive secretary in May, 1937. He has been engaged in tool engineering work for twenty years

Luke E. Beach, supervisor of processing, Packard Motor Car Company, has been first vice president of the A.S.T.E. for the past year. He also has served as a director and as second vice president

LE MAIRE TOOL & MFG. CO., *(270). Hydraulic drilling units and gear chucks, drilling machines.*

LINCOLN ENGINEERING CO., *(189-A).*

LINK ENGINEERING & MFG. CO., *(314). Spring checking devices.*

JOHN E. LIVINGSTONE & CO., *(297). Shop tools.*

LUFKIN RULE CO., *(277). Precision tools.*

M. B. PRODUCTS, *(152). Diamond tools.*

MCCASKEY REGISTER CO., *(222).*

MCCROSKY TOOL CORP., *(262). Adjustable reamers, boring bars, milling cutters, quick-change chucks and collets, turret tool posts, self-centering steady rest.*

MANUFACTURERS SALES CO., *(292). Grinders, tappers, screw-driving machines, trucks and hoists.*

MARBURG BROS., INC., *(223). Moore precision jig borer.*

MICHIGAN ASS'N. OF USED MACHINERY DEALERS, *(220).*

MICHIGAN TOOL CO., *(294). No. 860 gear finisher, rack-type gear finisher, gear lapper, tipped cutting tools.*

MICROMATIC HONE CORP., *(275). Hones and honing fixtures, Microhoner.*

MIDWEST TOOL & MFG. CO., *(263). Milling cutters, counterbores, reamers, form tools, special tools and adjustable tool holders.*

MINSTER MACHINE CO., *(156). Presses.*

Walter F. Wagner, mechanical superintendent, Lincoln Motor Company, was elected second vice president of the Society a year ago. Prior to that time he had been a director

MODERN COLLET & MACHINE CO., *(283). Collets, feed fingers, cams, spindles, automatic screw machine accessories.*

MORSE TOOL CO., *(246). Milling cutters, form tools, reamers, counterbores, core drills and spotfacers.*

NATIONAL TOOL SALVAGE CO., *(258). Cutters in different stages of reconditioning.*

NICHOLSON FILE CO., *(313). General line of files and rasps.*

O. K. TOOL CO., INC., *(326). Milling cutters and tool holders.*

PETERS TOOL CO., INC., *(356). Tool grinder.*

GEORGE H. PFEIL, *(182).*

PIONEER ENGINEERING & MFG. CO., *(336). Coolant and lubricant pumps and accessories.*

PRATT & WHITNEY CO., *(299). Small tools and gages.*

H. P. PREIS ENGRAVING MACHINE CO., *(358). Universal milling machine, die and mold copying machine, engraving machine.*

PROGRESSIVE WELDER CO., *(158).*

PUTNAM TOOL CO., *(257). End mills, counterbores, reamers and special tools.*

PYRO-ELECTRIC INSTRUMENT CO., *(319). Hardness testers.*

Q-C ENGINEERING PRODUCTS CO., *(345). Standard jigs and jig parts, live centers, multiple-spindle drill heads, control valves and production tools.*

RACINE TOOL & MACHINE CO., *(219).*

T. B. RAYLE CO., *(322).*

REED-PRENTICE CORP., *(375). No. 10-A plastic injection molding machine.*

ROBBINS ENGINEERING CO., *(259).*

ROSS OPERATING VALVE CO., *(242). Control valves.*

GEORGE SCHERR CO., *(348). Precision measuring and inspection instruments, chucks.*

A. SCHRADER'S SON DIV., SCOVILL MFG. CO., INC., *(362). Spray guns, airline fittings, safety control for presses, pressure gages, blow valves and blow gun equipment.*

SCULLY-JONES & CO., *(367). Reamers, counterbores, drill and tap drivers.*

SHEFFIELD GAGE CORP., *(189-B). Visual gages, break-down test of magnification mechanism.*

SINGER SEWING MACHINE CO., *(150).*

THE J. T. SLOCOMB CO., *(327). Precision tools.*

ROY SMITH, *(247). Hobart arc welders and accessories.*

SOCONY-VACUUM OIL CO., *(350).*

THE L. S. STARRETT CO., *(321). Precision tools.*

STOKER-UNIT CORP., *(267). Precision boring and lapping machines.*

CHARLES A. STRELINGER CO., *(324).*

STRONG, CARLISLE & HAMMOND CO., *(184).*

D. A. STUART OIL CO., *(234). Oil products.*

SUPER TOOL CO., *(183).*

SUTTON TOOL CO., *(264). Screw machine tools and collets.*

You are invited to visit the *American Machinist* Booth

240

while at this exhibition

SWARTZ TOOL PRODUCTS CO., INC., *(310). Standard fixtures and fixture locks.*

TAFT-PEIRCE MFG. CO., *(378). Magnetic V-blocks and parallels, gages, production and inspection tools, magnetic chucks.*

THOMAS MACHINE MFG. CO., *(362). Inclinable punch presses, press feeds, accessories.*

TOLEDO SCALE CO., *(346). Scales of various types.*

THE TOMPKINS-JOHNSON CO., *(331). Clinch-nut setting machine, riveting machine, hydraulic and pneumatic cylinders, remote-control valve system, milling cutters, coolant pumps.*

TRIPLEX MACHINE TOOL CORP., *(273 and 274). No. 3C jig borer and attachments, Maag gear grinder and gear testing instruments.*

VICKERS, INC., *(290).*

WEBSTER MFG. CO., *(374). Conveying and power transmission equipment.*

WELLS MFG. CORP., *(153). Bandsaw, tool grinders.*

WESSON CO., *(311). Tool grinders.*

WESTINGHOUSE ELECTRIC & MFG. CO., *(293). Flexarc welder, motors line-starters, circuit breakers, safety switchers, and detachable socket instruments.*

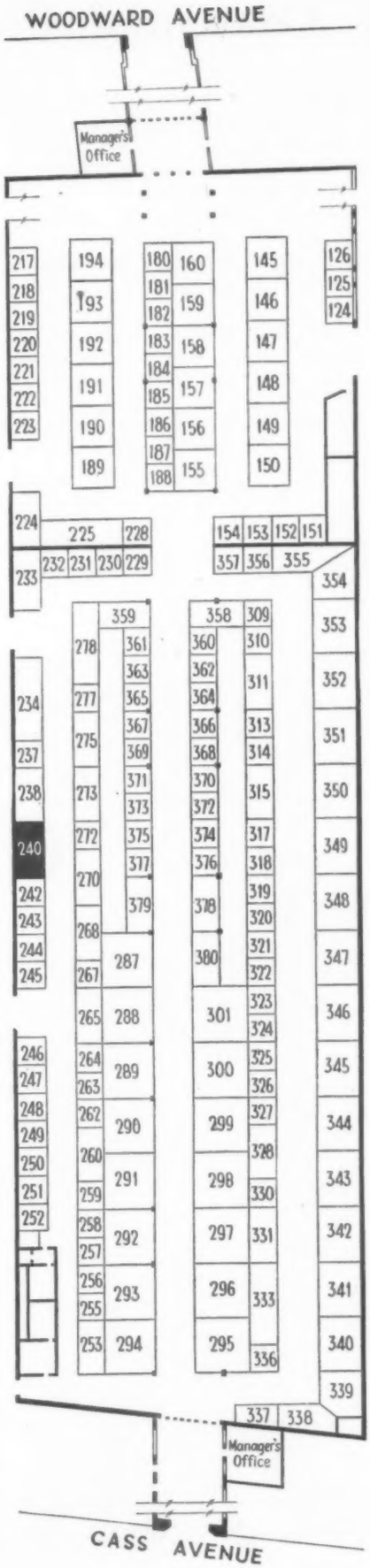
WETMORE REAMERS CO., *(237). Adjustable and solid reamers, boring bars, special tools.*

WHITHEAD & KALES CO., *(250). Welded steel products.*

J. H. WILLIAMS & CO., *(361). Wrenches, tool holders, C-clamps, lathe dogs and chain tongs.*

WILSON MECHANICAL INSTRUMENT CO., *(372). Rockwell hardness testers.*

CARL ZEISS, INC., *(301). Precision measuring instruments.*



Arrangement of booths for A.S.T.E. Show, Convention Hall, Detroit

Convention Program Schedules Evening Meetings

TECHNICAL sessions of the first annual convention of the American Society of Tool Engineers are scheduled for Wednesday and Thursday evenings, leaving the daylight hours free for inspecting exhibits at the Machine and Tool Progress Exhibition and for plant visits. Discussion will be confined to one major topic at each session, the presentation being in the form of a forum on the subject. J. R. Weaver, director of equipment, inspection and test, Westinghouse Electric & Manufacturing Company, East Pittsburgh, and chairman of the Pittsburgh Chapter of A.S.T.E. is chairman of the Program Committee for this annual meeting. He will preside at the two evening sessions, to be held in the Convention Hall Annex. Visitors to the Show are invited to these sessions.

Forum Discussions

Topic for the Wednesday evening session is "Preparing Standards for Surface Quality." Introductory paper will be presented by Dr. E. J. Abbott, president, Physicists Research Company. Following Dr. Abbott's paper, Harry T. Woolson, executive engineer, Chrysler Corporation, will discuss surface quality standards from the viewpoint of what they mean to the engineer. The production and tool engineer's point of view then will be discussed by R. V. Hutchinson, design engineer, Olds Motor Works, and F. J. Malone, assistant to the president, Hercules Motor Corporation. General discussion of the topic will follow the scheduled discussions.

"Selecting and Buying Equipment" is the subject scheduled for discussion on Thursday evening. Edwin Johnson, manager of costs studies, Packard Motor Car Company, will present the introductory paper. The shop viewpoint on this topic will be discussed by P. W. Brown, general factory superintendent, Wright Aeronautical Corporation, while the purchasing department's side will be given by Tom Higgins, purchasing agent, General Electric Company. The supplier's side of this important topic will be discussed by A. H. d'Arcambal, consulting metallurgist, Pratt & Whitney Company. Ralph E. Flanders, president, Jones & Lamson Machine Company, will speak on "The Tool Engineer" at the Society's annual dinner on Friday evening.

A charter member of A.S.T.E., Frank R. Crone, chief tool designer, Lincoln Motor Car Company, has been national treasurer of the Society for two years

C. Ray Brunner, tool engineer, Dodge Brothers Corporation, a former director and present secretary of A.S.T.E.

MARCH 9, 1938
WEDNESDAY

9:00 A.M. to 10:00 P.M.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 A.M.
Plant Tours

1:30 P.M.
Plant Tours

1:30 P.M. and 3:00 P.M.
Motion Pictures . . . Convention Hall Annex

6:00 P.M.
Dinner—Smorgasbord . . . Convention Hall Annex

8:00 P.M.
Technical Session . . . Convention Hall Annex
"Preparing Standards for Surface Quality" Dr. E. J. Abbott, president, Physicists Research Company
Discussion, Engineering Viewpoint: Harry T. Woolson, executive engineer, Chrysler Corporation
Discussion, Shop Viewpoint: R. V. Hutchinson, design engineer, Olds Motor Works
F. J. Malone, assistant to the president, Hercules Motors Company

MARCH 10, 1938
THURSDAY

9:00 A.M. to 10:00 P.M.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 A.M.
Plant Tours

12:30 P.M.
Board of Directors Luncheon . . . Fort Shelby Hotel

1:30 P.M.
Board of Directors Annual Meeting . . . Fort Shelby Hotel
Plant Tours

1:30 P.M. and 3:00 P.M.
Motion Pictures . . . . . Annex

8:00 P.M.
Technical Session . . . Convention Hall Annex
"Selecting and Buying Equipment" Edwin Johnson, manager of costs studies, Packard Motor Car Co.
Discussion, Shop Viewpoint: P. W. Brown, general factory superintendent, Wright Aeronautical Corporation.
Discussion, Purchasing Viewpoint: Tom Higgins, purchasing agent, General Electric Company
Discussion, Supplier's Viewpoint: A. H. d'Arcambal, consulting metallurgist, Pratt & Whitney Company

MARCH 11, 1938
FRIDAY

9:00 A.M. to 10:00 P.M.
Machine and Tool Progress Exhibition . . . Convention Hall

9:30 A.M.
Plant Tours

1:30 P.M.
Plant Tours

1:30 P.M. and 3:00 P.M.
Motion Pictures . . . Convention Hall Annex

6:30 P.M.
Annual Dinner . . . Hotel Statler
Report of National Officers
Installation of New National Officers
Address: "The Tool Engineer" Ralph E. Flanders, president, Jones & Lamson Machine Company

MARCH 12, 1938
SATURDAY

9:00 A.M. to 6:00 P.M.
Machine and Tool Progress Exhibition . . . Convention Hall

Can It Be Broached?

A few practical examples demonstrate broaching's entrance into new fields and the advantages gained thereby

HARRY H. GOTBERG
Designing Engineer, Colonial Broach Company

THE ART OF broaching—as nearly as can be told—dates back about 100 years. It is only in the last decade, however, that it has really come into its own—largely through the interest and support of the automotive industry.

Although that industry, at first, was primarily interested in broaching from a standpoint of more rapid completion of relatively standard operations, broaching recently has gone far afield in solving difficult production problems, frequently enabling the development of new and better engineering designs .

In addition, broaching has permitted the specification of close tolerances on parts which could not have been produced to those tolerances by other methods.

This has been true both of internal and external broaching. While the latter is largely thought of in terms of simple surfaces, external broaching now extends into many fields where the cutting of complicated forms, such as gear teeth, is involved.

Fig. 1, for instance, shows the fixture and broaches developed for broaching of gear teeth on a transmission synchronizer blocking ring. The ring has 30 teeth to be broached simultaneously. Alignment had to be held to close tolerances with the bore of the ring.

Fig. 2—This fixture is designed to hold a variety of roller bearing cages in which the openings are finished one at a time

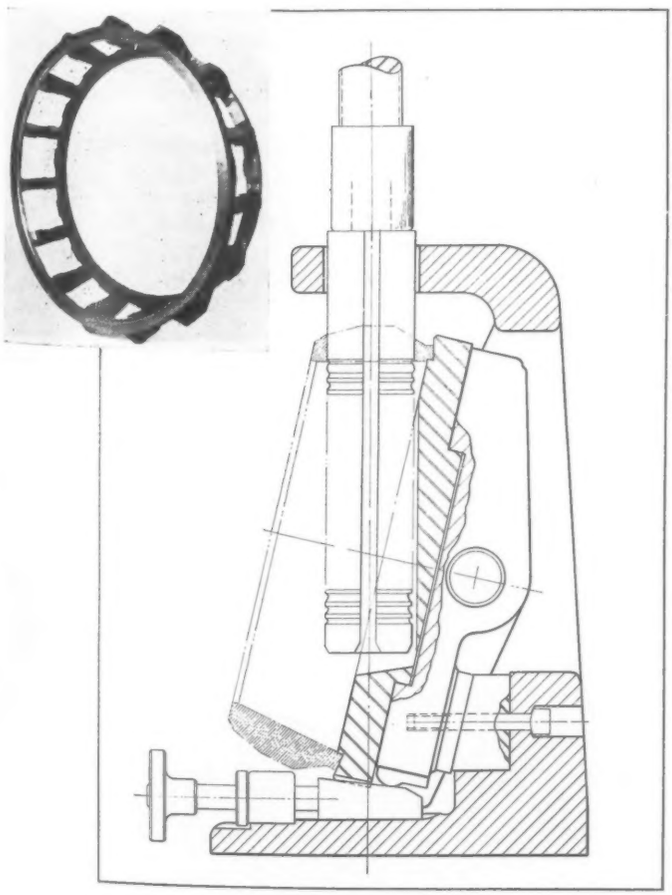
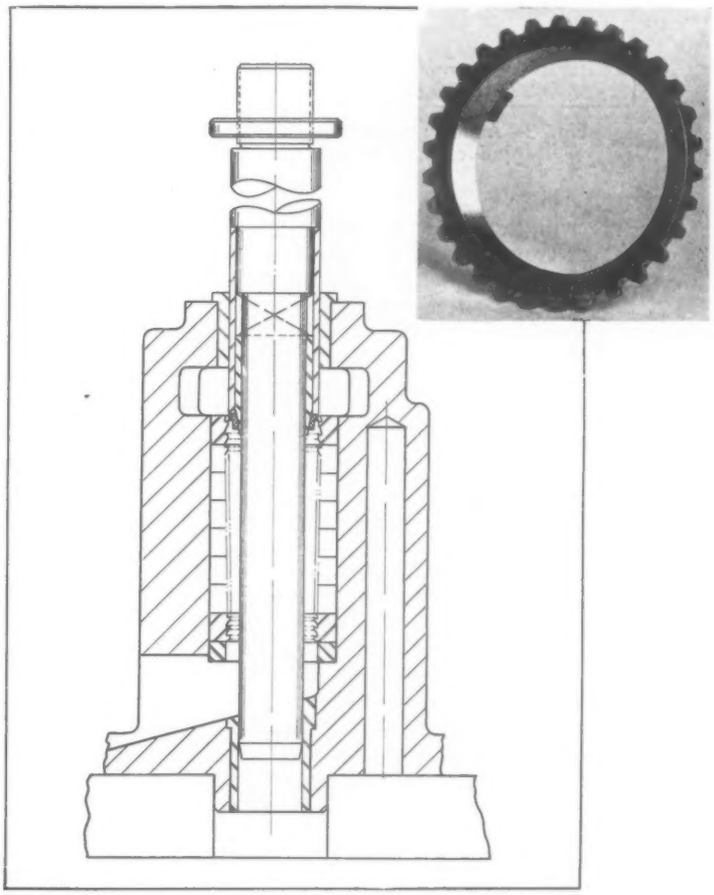


Fig. 1—Thirty gear teeth are cut by forcing the workpiece past the broach segments while firmly located by a guide bar



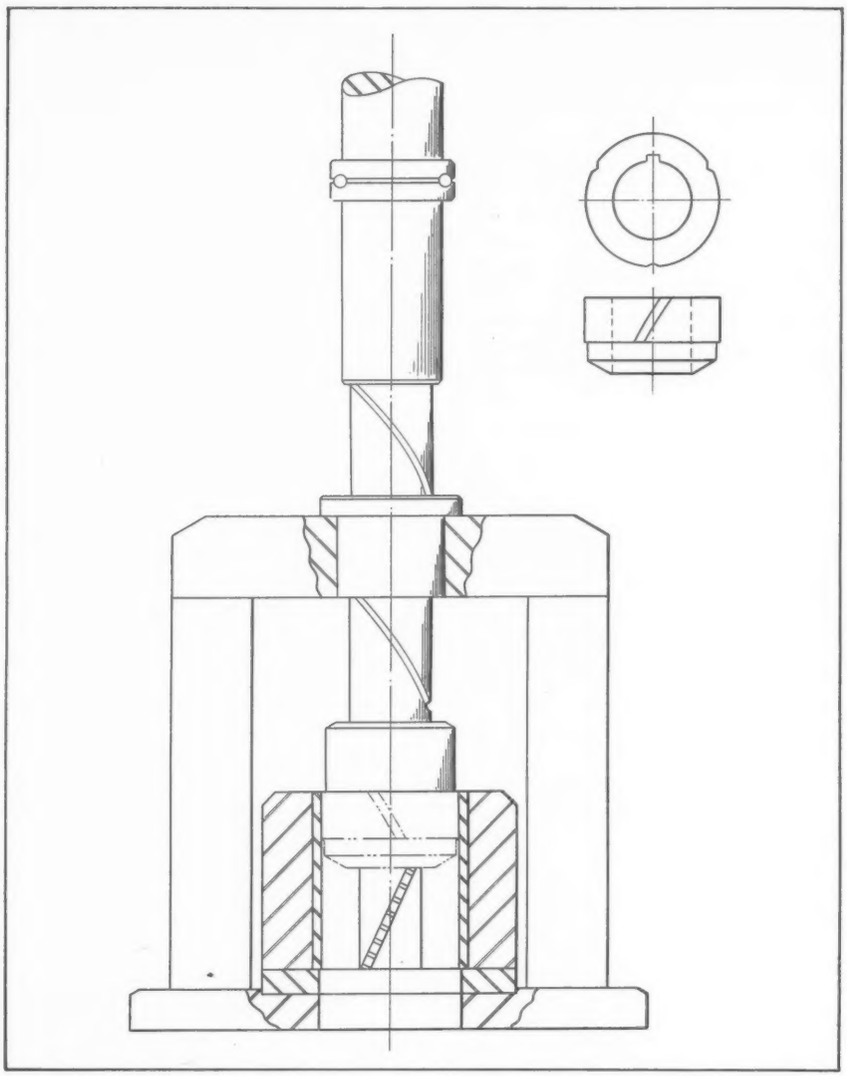


Fig. 3—Another push broach has a ball bearing bar extension which guides the workpiece for cutting external helical grooves

It will be noted that the part—shown cross-hatched in the drawing—is pushed through the fixture, the broaches being stationary. The part drops out at the bottom of the stroke.

With the ram at the top, the part is placed in the ground diameter at the top of the fixture. The ram travels downward, with the guide bar slipping through the bore of the part and into a guide bushing at the lower end of the fixture. This together with the guide bushing at the top, maintains alignment during broaching.

Only after the pilot bar has passed into the lower guide does the flange on the bar pick up the part and push it down through the broaches. The broaches are made in the form of annular segments, these segments being solid rings. Accidental breakage of broach teeth requires the removing and replacing of only one segment. At the bottom of the stroke, the ram reverses, and the part drops out down the slide shown.

In contrast with this operation, requiring high production on a single part, Fig. 2 shows the application of broaching to parts not produced in large quantities. The job was to finish the openings in large roller bearing cages—having inside diameters of 9 to 13 in. These bearings are being used on some of the new streamlined diesel trains.

The fixture had to be designed to take care of the different sizes on a single machine, the cages varying not only in diameter but also as to angular contact of rollers. A difficulty was that the cages had odd numbers of openings for rollers, making it impossible for the broach to pass through the part.

Strip broaching was resorted to, using a rectangular broach which is pushed though the cage opening, and returned to the top of the stroke in a single cycle. At the end of each cycle, the part is rotated to the next opening around the axis of the locating pilot.

While sizes of openings had to be held to close tolerances, spacing between openings could be held to commercial tolerances, making it possible to use the broach pilot itself for final index locating of the part. This was facilitated by provision of guide slots for the broach in the top of the fixture, close to the part itself, and by providing "lost motion" between the ram and the broach.

The main part of the fixture is pivoted, it will be noted, to accommodate different roller contact angle cages. Adapter plates and angle

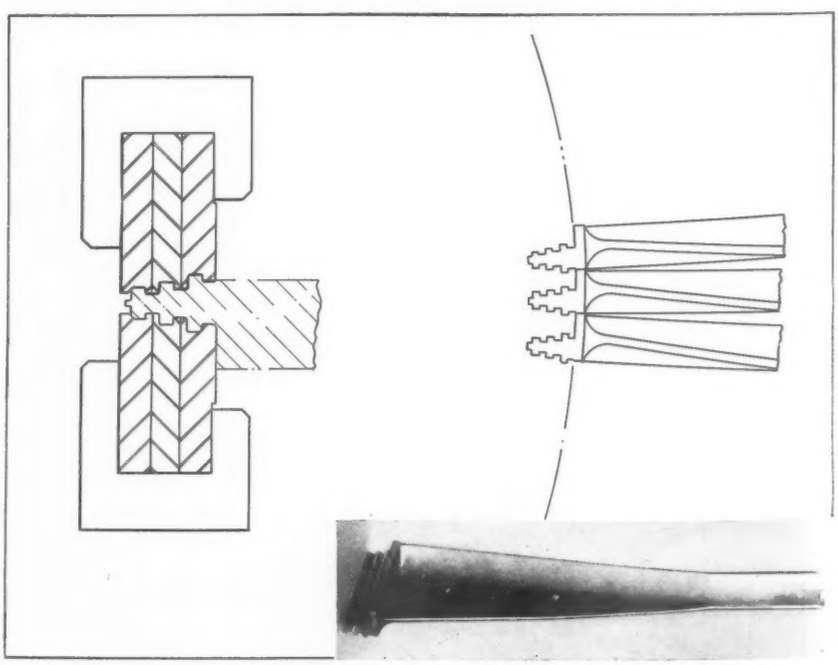


Fig. 4—Armature blades are held stationary while slots are cut in their ends by means of sectional external broaches

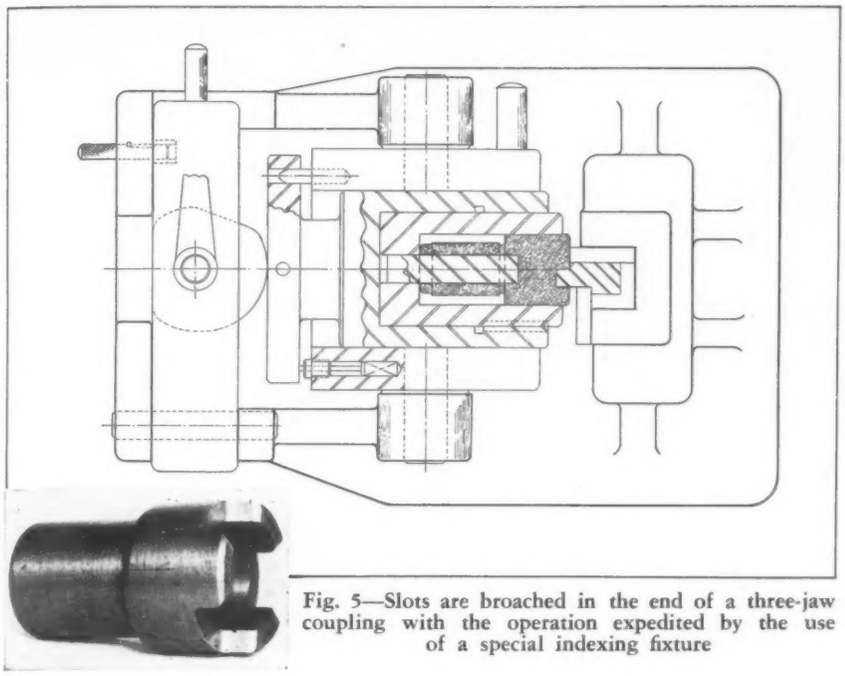


Fig. 5—Slots are broached in the end of a three-jaw coupling with the operation expedited by the use of a special indexing fixture

locating blades are provided for the different sizes.

The combination while extremely simple, has proven highly effective and should lend itself well to other applications where small production of different size large parts of similar design are required.

A problem frequently encountered is the machining of external helical oil grooves in such parts as guide bushings. An effective way of handling this with broaching was developed by Colonial and is illustrated in Fig. 3. This also is a push-broaching operation, with stationary broaches and the part pushed through the broaches.

In the particular case illustrated, the part—shown at the right of the fixture—required the machining of three helical grooves. Broaches are simple, consisting of helical inserts mounted at an angle conforming to the desired helical lead of the groove. The ram of the broaching machine was provided with a helically grooved extension, separated from the upper part of the ram by ball bearings.

As the bar travels down, the helical grooves, which mate with projections in the stationary guide bushing in the top of the fixture, cause the bar to rotate and turn the part by engaging the keyway shown. The part is thus pushed and turned through the fixture and drops out through the bottom, the ram returning to the top of the stroke to complete the cycle. With this arrangement a standard broaching machine can be effectively used.

Broaching also solved a tough problem for a manufacturer of large armatures. Some of these run as much as 6 ft. in diameter, and to avoid weight, the manufacturer desired to support from the hub the outer ring of the armature on which the winding is located, by means of a large number of light weight blades.

The arrangement at the hub is illustrated at the right of Fig. 4. It will be evident that the fit of the blades at the hub must be extremely accurate—with metal-to-metal contact for the entire contour specified. As a matter of fact, maximum permissible accumulated error of contours had to be held to 0.0002 in., with a light tap fit specified, so that the blade would be absolutely vertical when assembled.

The fixture locates the blade from both ends and holds it in correct relation to the broached surfaces. Broaches were made in three sections for each side to permit adjustment of each step individually to proper height.

In this case, of course, the part is held stationary while the external or "surface" broaches are moved through guides in the fixture, close to the part. For finishing the slots in the rotor itself, single-point broaching swedges are being used, the slots being first rough machined.

A good illustration of the high productivity possible with broaching, compared with other methods, is illustrated in Fig. 5, representing the broaching of a flexible coupling. The slots between the three jaws were formerly milled at the rate of nine to ten an hour.

Broaching stepped this up to between 50 and 60 an hour. Three passes of the broach finish the three slots, with indexing after each cycle of the broach. The drawing shows the top of the fixture, which is pivoted two ways. To load the part, the fixture is swung back and the part dropped into a locating bushing over a mandrel.

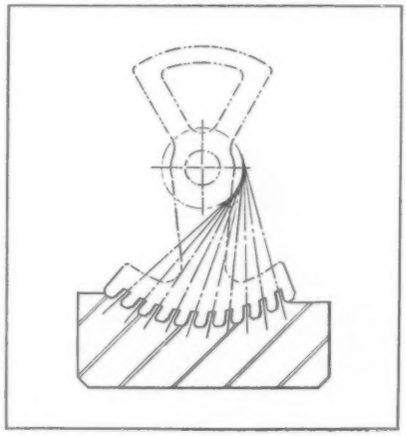
At the end of the first stroke of the broach, a cam in the fixture pulls back the locating bushing and part. This permits indexing during the return stroke of the broach. Index locating is by means of the pin shown at the extreme left. Just below this pin is a hand-operated cam for pushing the locating bushing and part back and locking it in broaching position after indexing.

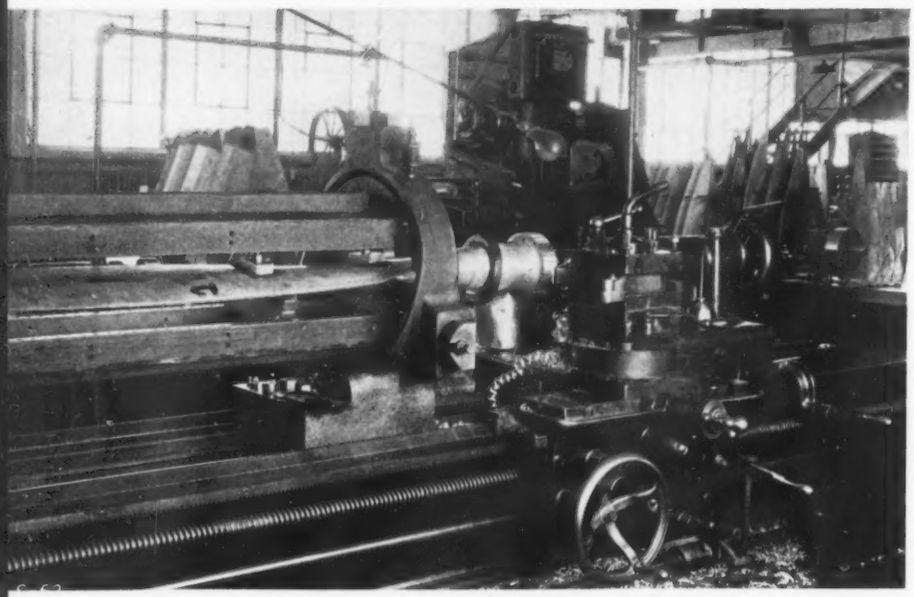
The broach may be classified as a keyway slotting broach of special contour, designed to produce the proper radii at the corners in addition to finishing the jaw faces.

An excellent illustration of the ingenuity often required of broach manufacturers is illustrated in Fig. 6 showing the broaching of a sector for a tabulating machine. While the part looks simple, it was complicated by the fact that the slots, which are only 0.080 in. wide, are generated from a theoretical circle to which they must be tangent.

While the broach might have been made solid, it was considered preferable to make it in segments in order to reduce replacement cost in case of damage to the narrow broach teeth. Production of the broach, nevertheless, required special processing, extreme care in grinding, and the development of special fixtures and equipment not only to maintain the accuracy required as to tooth spacing itself, but also to provide the unusual angular relations required, without damage to the broach teeth.

Fig. 6—A sectional broach reduces replacement cost when machining narrow slots in a tabulating machine sector





Machining the blade starts by rough turning the outside diameter of the shank. The work is done in an engine lathe with the blade held in a special rotary fixture which drives from the flat surfaces. The method of chucking insures that excess stock will be equalized so as to clean up properly in subsequent operations

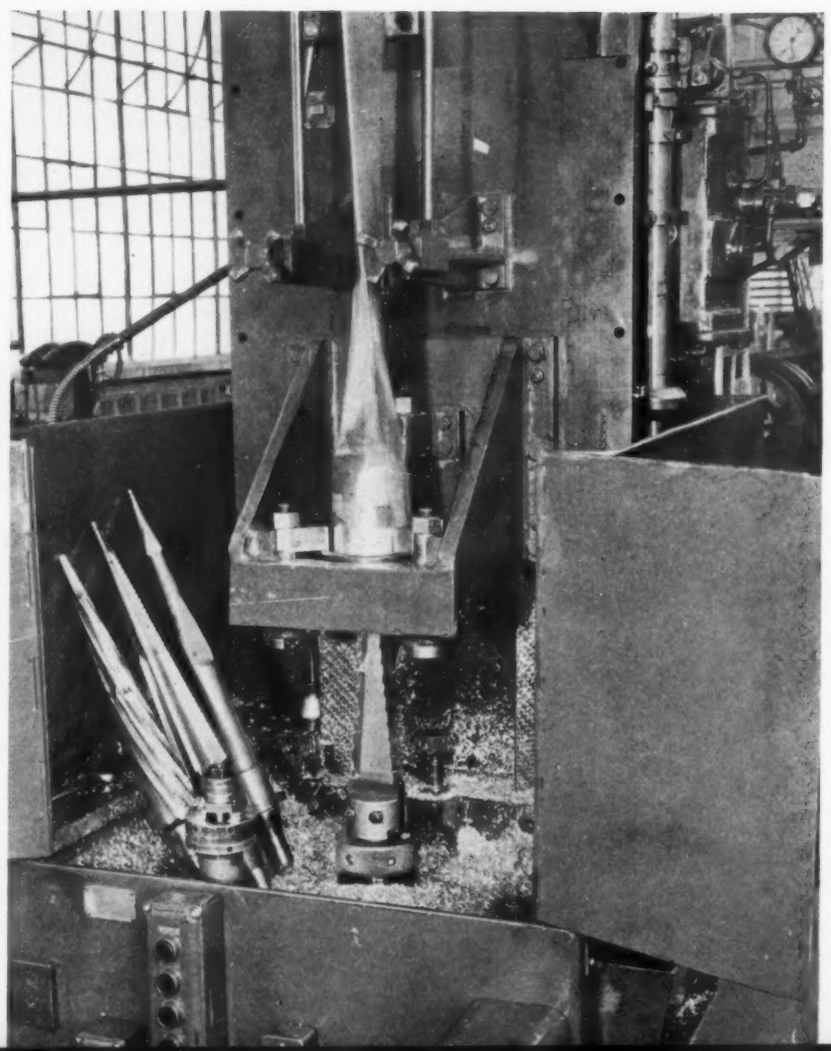
Controllable Pitch

UNTIL THE Controllable blade propeller became commercially practical, aircraft propulsion was a compromise. The fixed blade had a pitch suitable only to one altitude, one r.p.m. and one air speed. Any variation from these conditions meant a sacrifice in developed horsepower.

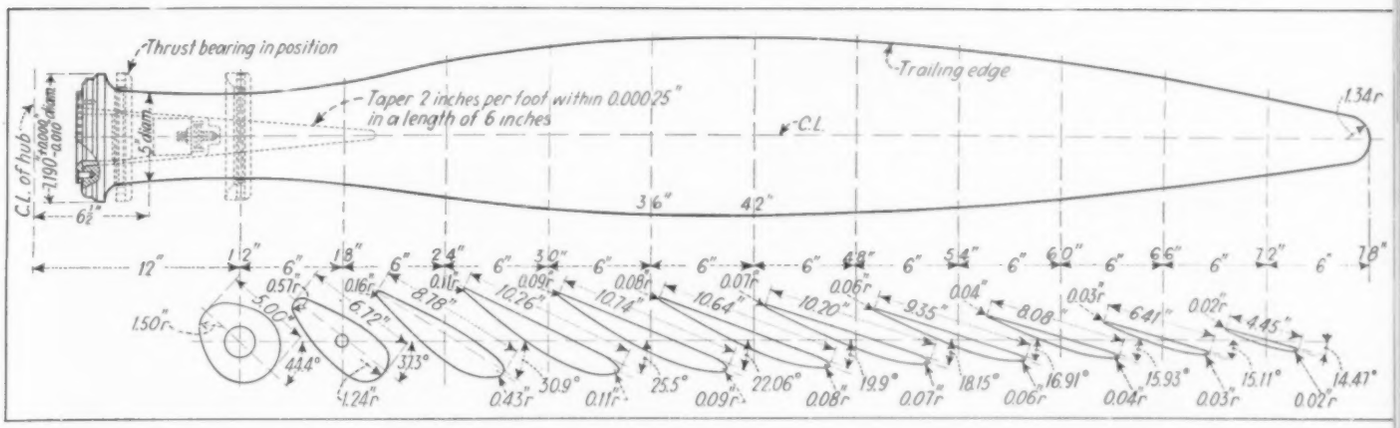
Most widely used of controllable blade designs is that manufactured by the Hamilton Standard Propeller Division of the United Aircraft Corporation and licensed by this company for the use of leading aircraft builders throughout the world.

In addition to the two-position blade, adjusted by the pilot for high and low pitch, Hamilton now supplies the constant speed propeller which makes pitch variation an automatic process.

This design has an engine driven control unit which sets the blades



Located from the rough turned hub the blade is held in one of a battery of three special vertical Natco machines while the bore is drilled and reamed. A special set of tools performs these operations from the bottom of the workpiece allowing chips to fall clear of the tapered bore. The tools revolve while the work-holding slide is fed downward



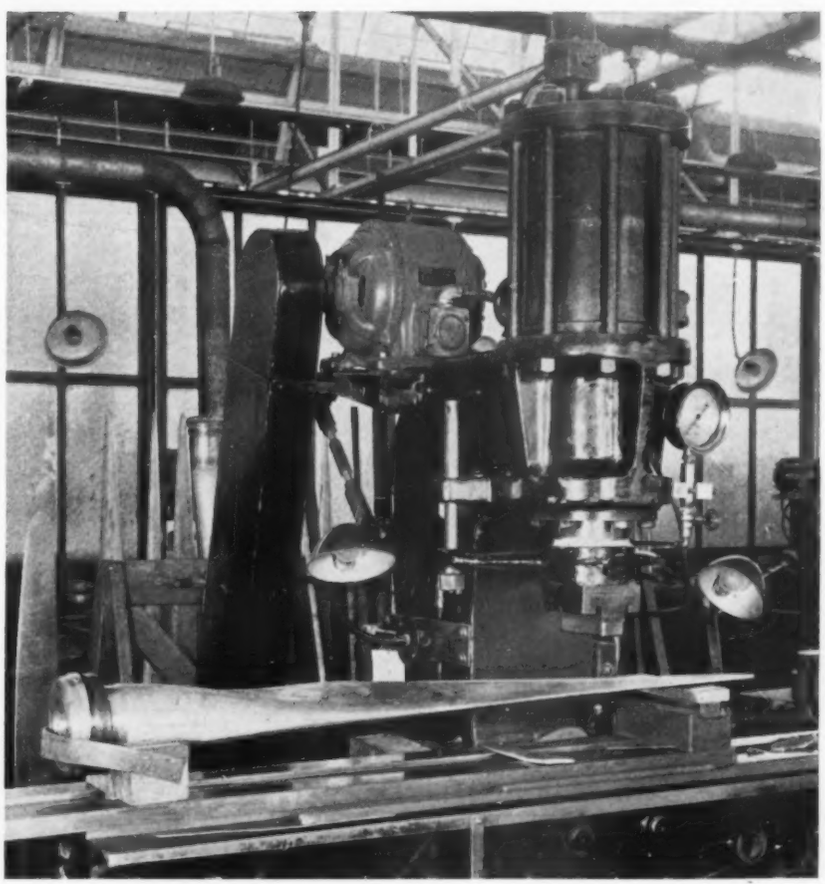
Hamilton propeller blades are forged from 25 ST aluminum alloy heat-treated to an ultimate tensile strength of 55,000 lb. per sq. in. Their irregular contours require a unique set of machining operations. Propellers are made in two- and three-blade types of eight standard designs. After the blade is forged, but before its hub end is upset, a steel retaining ring is put into place. This ring acts as a collar to take bearing thrust and of necessity follows the blade through the shop

Propellers in Process

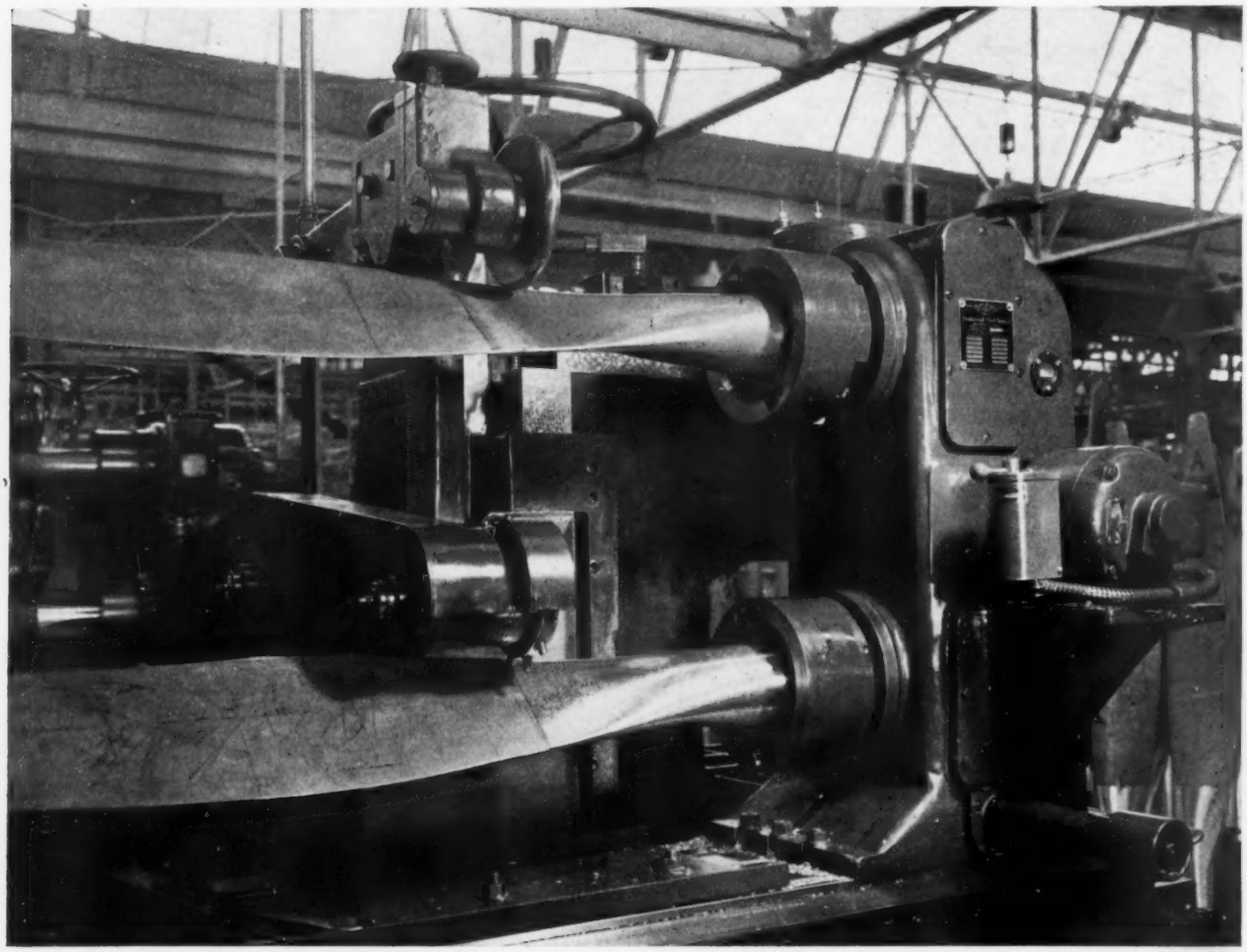
to hold constant r.p.m. whether the plane is flying, climbing or diving. Both pilot controlled and automatically controlled designs call for the highest possible manufacturing skill, for the propeller assemblies must withstand high speed and enormous centrifugal force. Human life depends upon their correct functioning.

On this page and those following are shown some of the key operations on the main members of Hamilton propeller assemblies. These views reflect the extreme attention to detail in the manufacturing process that has made this product a leader in its field.

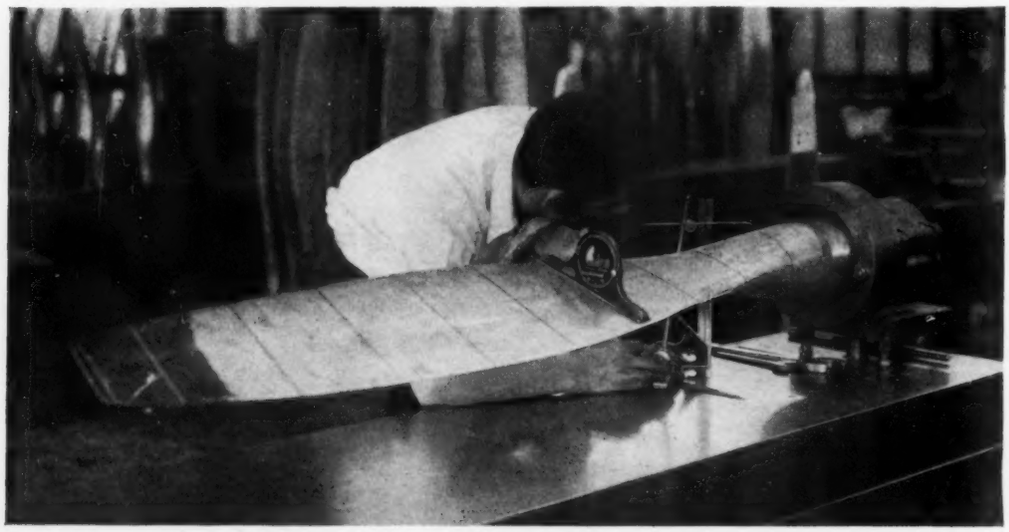
Because of the irregular contour and exacting requirements on the Hamilton propeller blade machining operations on this part are of particular interest. Other main components of the propeller assembly are the barrel spider and counterweight. Views of the manufacturing methods on these parts will be shown in an early number.



After the shank is turned and bored, the blade is restraightened in an Oilgear hydraulic press. This operation corrects any distortion caused by the prior machining operations

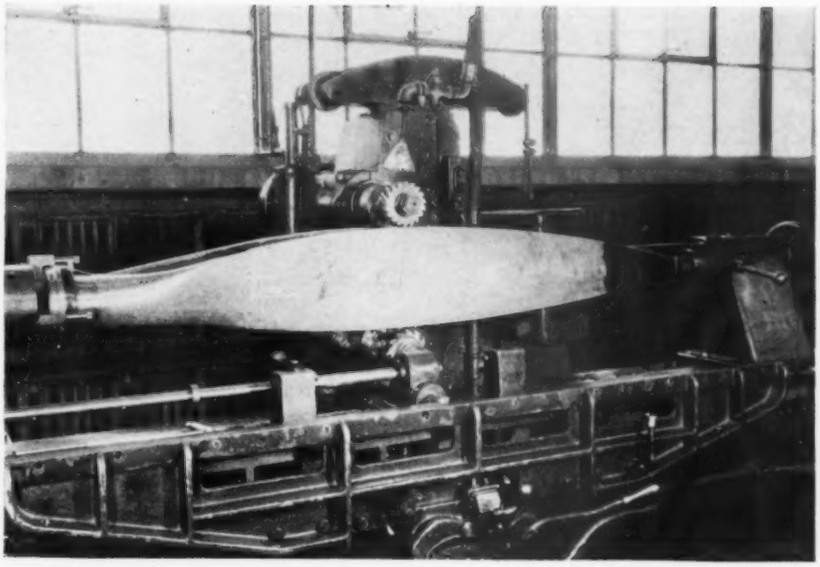


A Sundstrand Rigidmil is adapted to machine the shank end of the blade. A master blade is mounted directly above the workpiece and is rotated with it. A roller follower in contact with the master causes a cutter of the same diameter to trace an identical path thus duplicating the contour. With both master and blade traversed on the worktable, this operation is carried to a point 21 in. from the centerline of the hub where the blade becomes so flat that another means of forming the contour becomes more suitable

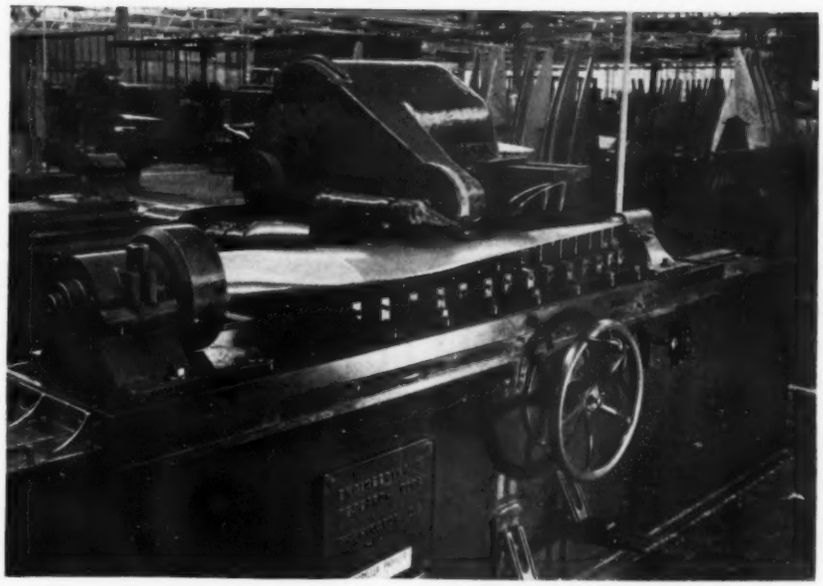


Carefully mounted in a master hub, the blade is laid out on a surface plate using protractor and surface gage. The centerlines and longitudinal divisions are accurately marked

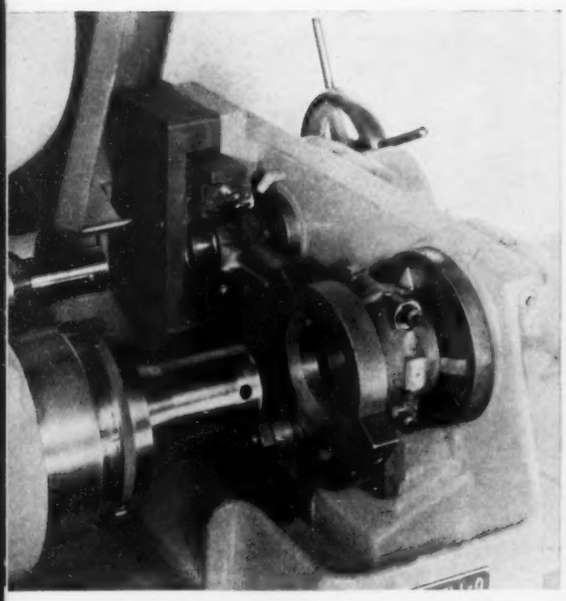
Edges of the blade are also machined in a converted Rigidmil. For this work the blade and master are mounted side by side with the roller followers held on the same arbors as the milling cutters. One work head is used for each edge of the blade. The upper one is held against the master by gravity while the lower one is forced upward by means of a counter-weight. As the blade moves past the cutters, it is revolved by a side cam to take care of the twist caused by the pitch



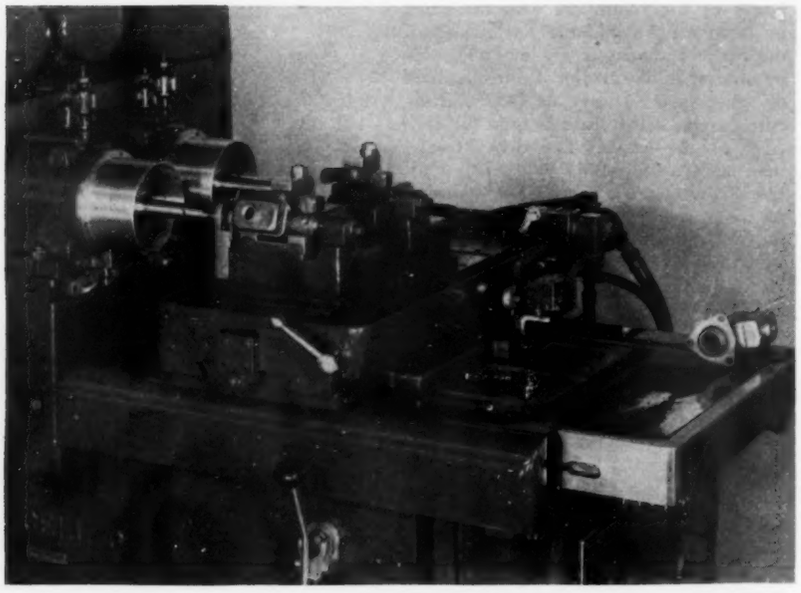
Flat sides of the blade are machined on special equipment developed by the Engineering and Research Corporation. Again a circular milling cutter does the work, but in this case, a drum type is used. The cam is geared to the table so that it revolves once during the traverse of the blade. An advantage of this machine is that the cam may be cut by putting a cutter in the normal follower position and a master blade in the work position. Set up in this way the machine reverses its customary process and forms the drum cam from the master blade. If the machine is then geared one-to-one the master blade is reproduced. If it is desired to make a shorter blade having the same pitch characteristics, the machine may be set up to "telescope" the contour; that is, the gearing between table reverse and cam movement may be less than one-to-one to give the same change in cross-section in a shorter blade length. One side of the blade is machined first, and a second machine is used for the opposite side. Adjustable stops are brought up to the unfinished surface to support the blade in the first set-up while a roller arm holds it down with uniform pressure. In the second set-up, stops are fixed to fit the contour already profiled



Completion of the blade consists of a series of grinding and polishing operations during which great care is exercised to maintain blade balance. Lead wool may be inserted in the tapered bore at the hub end to obtain horizontal balance



A typical steel application of carbide is boring connecting rods of 22-26 Rockwell carbon steel with no oil holes



The master brake cylinder is made of steel tubing 4¾ in. long and 1¼ in. in diameter. In a dual set-up the tools go through the work, shift to cutting position and cut on the return stroke; speed, 560 ft. per min.

Carbide's Place in Finishing Steel Parts

Carbides tools may be used successfully in precise sizing if the user ignores precedent and concentrates on the needs of his particular problem

CARL PULVERMACHER
Experimental Engineer, Ex-Cell-O Corporation

OVER THE YEARS, industry has developed a pretty definite technique when it came to machining cast iron or non-ferrous parts with tungsten-carbide tools. Given a certain part and the job to be done, the best feeds, speeds and depths of cut on a given machine for best results can be foretold with reasonable accuracy.

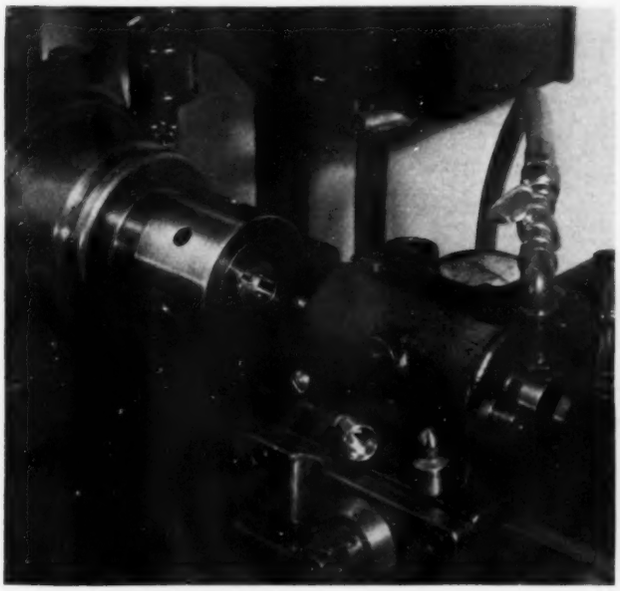
But when that part is made of steel, previous experience more often than not is almost useless. Virtually every job is tailor made. Beginning with the selection of the proper grade of tantalum or titanium carbides (tungsten carbides are not as well suited to the cutting of steels), the design of the tool itself and the selection of feeds and speeds are individual problems for every new application met with every day.

Nevertheless, carbides today are making rapid headway in their application to the machining of steel, particularly for precision finishing, where—as on cast irons—they have largely displaced diamonds because of their lower cost, particularly in view of breakage.

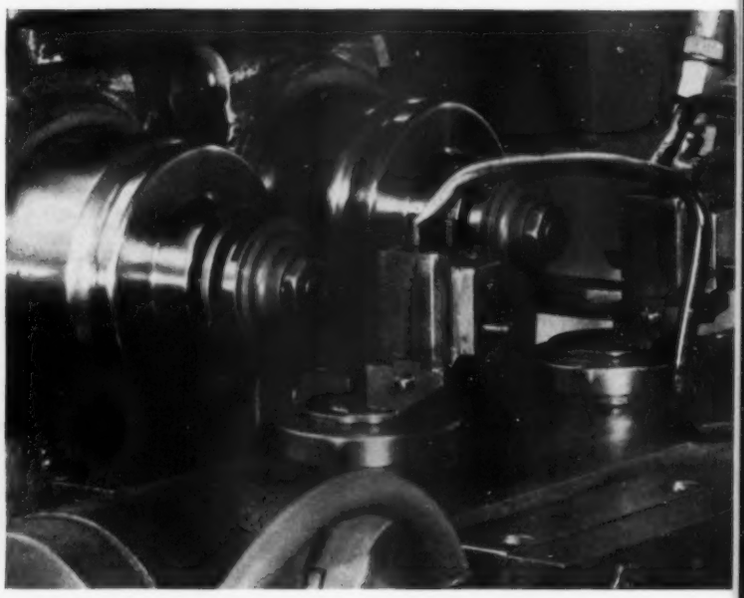
At Ex-Cell-O, we are primarily concerned with precision finishing; this permits us to eliminate from consideration at least the usual variable influencing factor of depth of cut. Peculiarly enough, we—in the United States—have had better success in applying carbides to finishing work than to roughing, the reverse of experience abroad. Nevertheless, each job has to be separately engineered and followed through in order to assure best results.

For instance, there is the problem of interrupted cuts. It has been generally assumed that interrupted cuts are unsatisfactory for carbide tools from a tool life standpoint. While interruptions, in cutting steel, are more serious than on cast iron, they do not necessarily make the job impossible. It just means that more care must be taken.

On cast irons, on the other hand, interruptions actually may be helpful. We are finishing some parts with interrupted cuts at as much as 900 ft. per min. with remarkable tool life and believe we can attribute part of this performance to the interruptions in the cut.



Push-rod ends for aircraft engines are reverse bored with carbide. The bottom of the hole is faced; then the bore is cut on the out stroke. A dial indicator facilitates tool setting



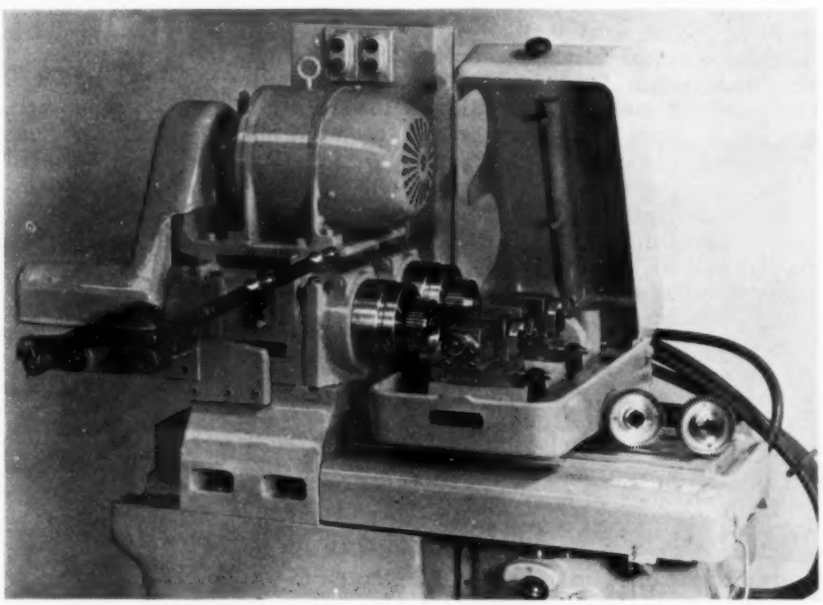
A single point tool turns the hub, generates the radius and bores the flange of heat-treated alloy steel valve spring washers. Depth of cut 0.005 to 0.010 in.; speed, 400 ft. per min.

Cutting speeds for steels do not seem to bear any definite relation to tool life, although we have found that an average of 400 to 425 ft. per min. is a good mark to shoot at on the majority of finishing jobs. Tool life in steel cutting is sometimes improved by reducing speeds, but not often. On the other hand, the higher the speed, the better the finish usually obtained.

Apparently there seems to be little limit to the hardness of certain steels that may be cut with carbides. Today, for example, we are turning heat-treated stainless steel, of 520 Brinell and better, at 400 ft. per min., to tolerances that eliminate lapping of mating tapered parts which have to fit airtight under 100 lbs. pressure.

One thing might be pointed out in connection with hardness: The ability to cut steels depends on the physical characteristics of the steel as well as on its chemical composition. Two identical steel jobs, differently heat-treated, may require considerable variations in the application of carbides for cutting them.

Two titanium tools used to (1) turn the hub and (2) face steel gears for an automobile transmission. Depth of cut 0.005 in.; speed, 425 ft. per min.



One of the most important factors governing the successful use of carbide tools in steel-cutting is the care which is given to the tools. Improper care, too infrequent sharpening, and non-adherence to definitely established cutting and clearance angles all work against the success of the installation.

For precision boring operations, it is sometimes desirable to do the cutting on the return stroke. This permits the chip to curl up inside the work; the chip space thus increasing instead of decreasing during the cut.

As to tool design, it is hard to generalize. Again, each job must be separately considered. Frequently a negative back-slope works better than a positive back-slope. Front clearance for the tool should be held as small as possible to provide maximum support for the tip. Tool holders should be rigid and as close to the work as possible. In the case of boring tools, chip breakers ground into the tool are usually wasteful of costly carbides.

Bottle Tumblers

Small parts used in instrument work are sometimes tumbled in square, or odd shaped, cosmetic jars with a metal screw top. The top is fastened to a shaft, geared to the proper speed, and the loaded jar then screwed into place. A study of tumbling speeds and abrasives often saves a lot of money, particularly in tumbling small parts.

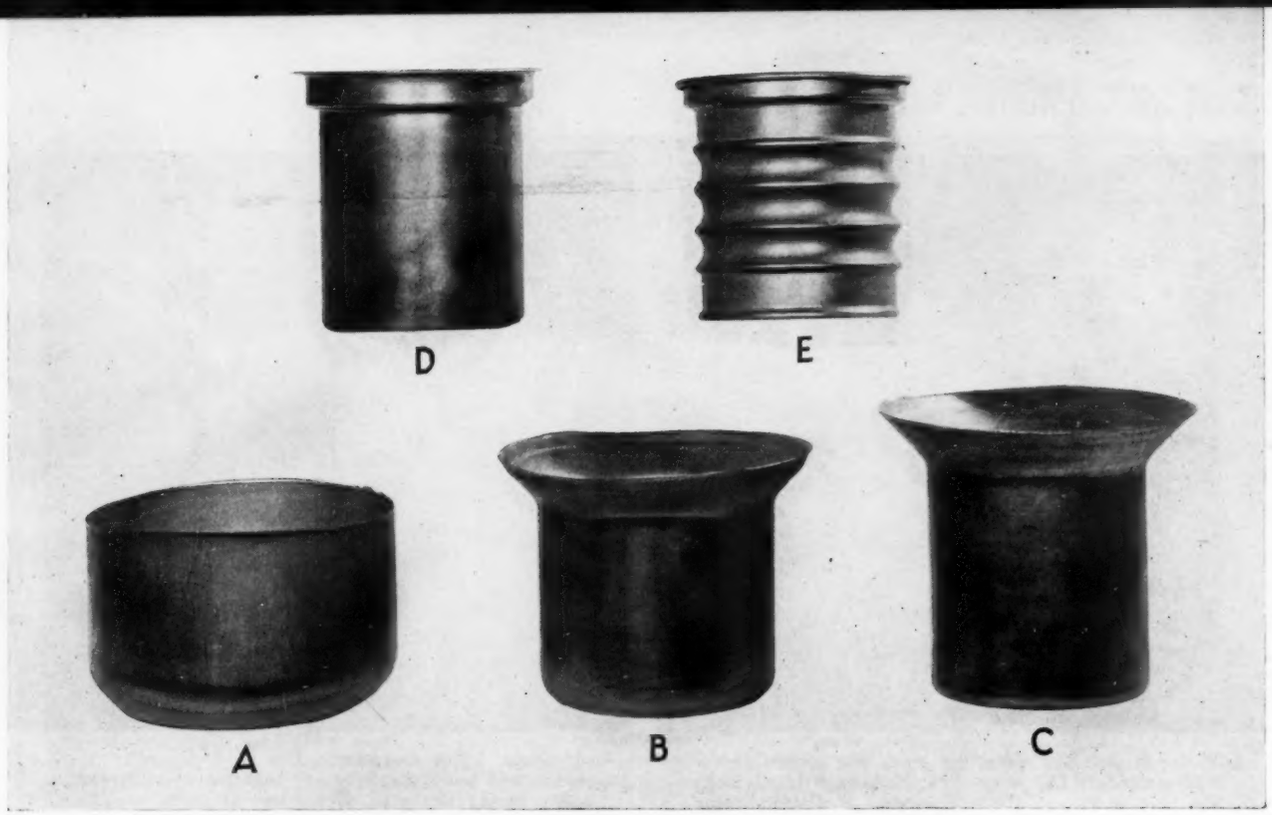


Fig. 1—Lamp-base *E* was produced by rolling shell *D*, utilizing a formed roller on a trimming and beading lathe

Shells Rolled on the Wall Surface

III—Deep corrugations on the wall of a deep-drawn shell can be made faster by rolling than by spinning

MARK GOLDEN

IN THIS final article on the rolling process for forming shells, I shall describe the production of ornamental corrugations in a deep-drawn lamp base where the change in shape covers a length of $3\frac{1}{4}$ in. This amount of surface might be thought difficult to handle, but very little trouble was experienced in obtaining perfect results the first time the tools were set.

The shell is drawn in either 22-gage brass or copper, and the blank used is $7\frac{3}{4}$ in. in diameter. The first operation drawing die, Fig. 2, produces the straight-sided shell shown at *A*, Fig. 1. Both the die and blank holder are of cast iron and have inserted rings of tool steel. Both rings are alike with the exception that the lower die ring has a $\frac{3}{16}$-in. drawing radius. Three pins in the cast-iron die shoe locate the blank, but only one pin is shown for convenience. The punch is made of cold-rolled steel and is tapped $1\frac{3}{8}$-in.—8 threads per in. for a standard attachment to the draw-press ram. A 45-deg. angle at the working end of the punch, and a flat $3\frac{1}{4}$ in. in diameter size the shell for the next operation. When drawn in this die the shell is $4\frac{3}{8}$ in. in diameter and has a depth of $2\frac{3}{4}$ in.

Redrawing is done in the die shown in Fig. 3 and the shell appears as at *B*, Fig. 1. The shell now has a depth of $2\frac{3}{4}$ in. below the 45 deg. flange, is $3\frac{1}{4}$ in. in diameter, and the flange will be used to form the enlarged step on the shell as well as the bead. A tool-steel die ring having an inside diameter of $3\frac{1}{4}$ in. is held in a cast-iron shoe, and this ring has a 45 deg. angle that corresponds with the angle on the first-operation shell. The blank holder has the same angle, is machined on the top surface, and ground on the diameter and angle.

Except for size the third-operation die is similar to the second-operation die. The shell is reduced to 3.100 in. in diameter and is drawn to a depth of $3\frac{1}{8}$ in. below the flange. An angle of 45 deg. is still maintained for the flange which now has a length of 1 in. The shell at this stage is shown at *C*, Fig. 1. Annealing is required previous to the third operation when the shell is made of brass, but when made of copper the shell can be put through the entire series of operations without such treatment.

The fourth-operation die, Fig. 4, forms the shoulder on the shell and leaves a flange for forming a bead. The part now appears as at *D*, Fig. 1. The cast-iron body of the die has a tool-steel ring for forming the shoulder. Cast-iron is employed for the blank holder, but the punch, as in the other dies in this set, is made of cold-rolled steel. A knockout in the die is fitted with an inserted tool-steel point which forms a center in the bottom of the shell. The point presses the metal against the vent hole at the end of the stroke. Before being put through this operation, the rough uneven flange is trimmed to avoid cracking the edge of the shell.

The next operation is that of rolling the bead. This is done on a trimming and beading lathe, and the shell is now ready for rolling to shape.

No Tail Block Required

Fig. 5 gives a birds-eye view of the tooling used in rolling the shape on the shell as shown at *E*, Fig. 1. Fig. 6 is a schematic layout of the chuck and roller in position and the outline of the shell in place. The difference in diameter between the chuck and shell allows the completed shell to be removed after rolling. No tail block is required to hold the shell in place. Point X on the roller passes the corresponding point X on the shell and thereby holds the shell in proper position.

In making the chuck and roller, attention was paid to proper clearance between the curves and steps so as not to "choke" the flow of metal while rolling. For example, when only the thickness of the metal was allowed at the radii, difficulty was experienced. When the clearance was increased by $\frac{1}{64}$ in. the metal flowed easily. In fact, the metal almost "ran" into place. Therefore, while the semi-circular grooves on the chuck have a $\frac{3}{8}$ in. radius, the corresponding radius on the roller is $\frac{5}{16}$ in., and on the rolled shell it is $\frac{11}{32}$ in.

Rolling action causes an increase in diameter of the shell from 3.100 in. to 3.200 in. because of the flow of the metal under pressure. Comparatively little pressure was required to complete the operation. This was surprising because the rolled surface is $3\frac{1}{8}$ in. long and the shell is reduced by $\frac{3}{16}$ in. at the two flat steps and by $\frac{1}{4}$ in. at the grooves.

As in the other rolling operations already described, the trimming lathe on which this shell was rolled ran at 1,000 r.p.m. Time for rolling was 3 sec. per shell, giving a production of 20 per min. The former spinning process gave only nine or ten per hour. Of course, the spinner had to do this job "on air" and to mark the shell with a gage for location of the grooves and steps. From the production point of view the rolling process was a very satisfactory change.

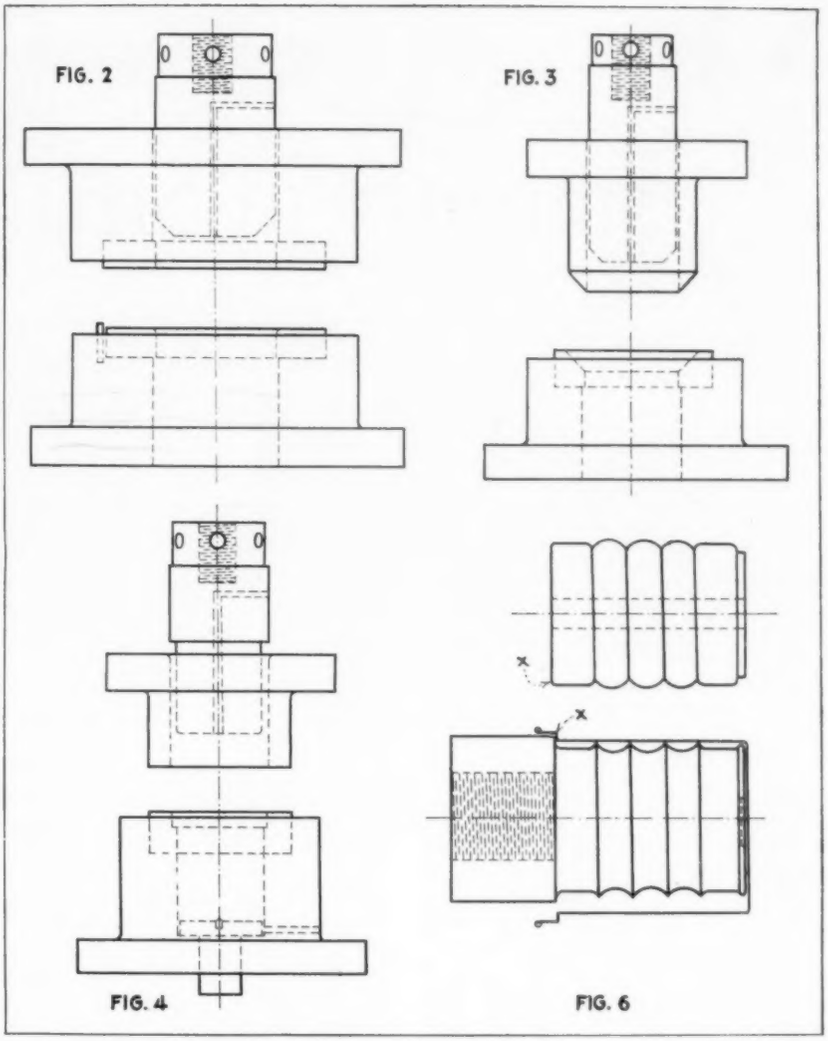


Fig. 2—A punch with a 45-deg. angle on the nose was used in the first drawing operation. Fig. 3—A 45-deg. flange was thrown up on the open end of the shell by the second-operation tools. Fig. 4—In the fourth operation the shell was made ready for rolling. Fig. 6—To allow the metal to flow properly during rolling, the radii on the roller were made smaller than the radii on the semi-circular grooves in the chuck

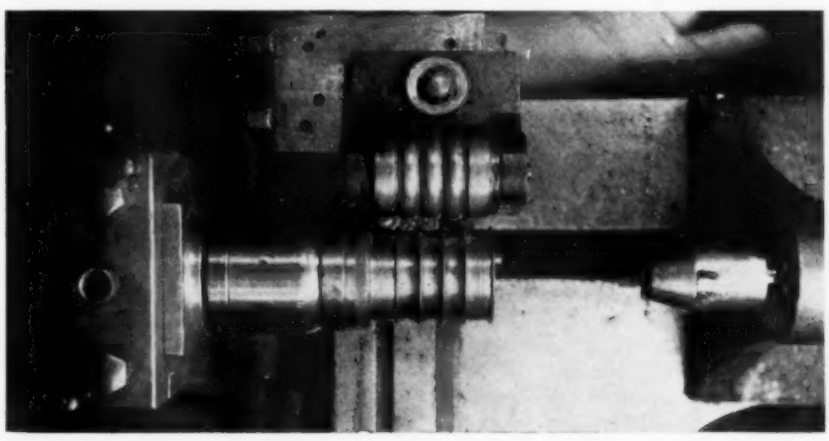


Fig. 5—No tail block is required to hold the shell on the chuck while the long roller does its work

Stamina in Small Tools

Scientific control of metallurgical processes begins with steel selection and ends only with satisfactory performance in the customer's plant

DR. WILLIAM R. FRAZER
Metallurgist, Union Twist Drill Company

MODERN MACHINE practice and engineering specifications call for fast production, good finish and close tolerances. This requires the manufacture of cutting tools to precise specifications, correct clearance and careful control of tool contour. The ability of the tool to withstand production requirements is effected by metallurgical control in the manufacture of the tool. The cutting stamina that is possessed by a drill, reamer or milling cutter depends upon the quality of the material used and the way the tool is heat-treated to develop the correct characteristics for the service required.

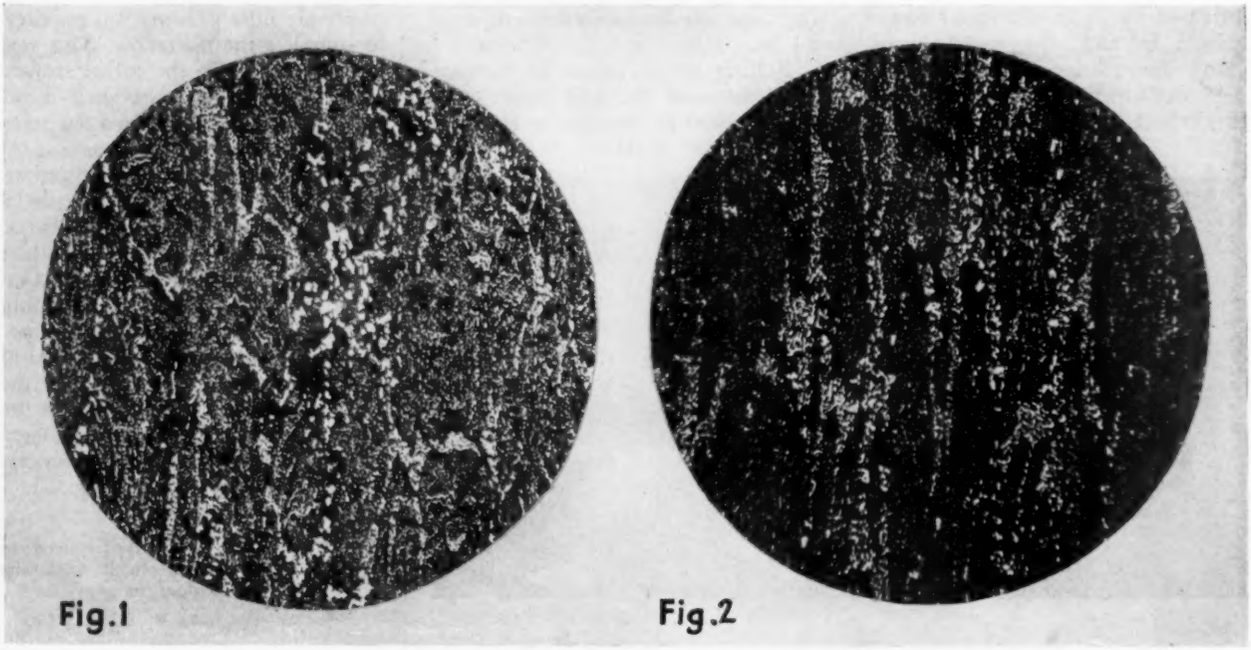
Since the greater percentage of tools manufactured today are made from high-speed steel, this discussion covers only the metallurgical control system adopted for high-speed steel tools.

Metallurgical control of the raw materials used in the manufacture of cutting tools really begins in the melting department of the steel mill. It is necessary for the steel-mill metallurgist to determine the proper size ingot to use for making the finished bar, which will meet the tool manufacturer's specification. He also must standardize the teeming practice so that he can commercially duplicate and maintain uniformity of quality in the finished bar stock on repeat orders. This is as important as controlling the chemical composition of the steel.

Obviously it is impossible for the tool manufacturer to dictate mill practice. However, by close cooperation with the steel-mill metallurgist, whereby discussions are had regarding the quality of material desired, a mutual understanding is affected whereby a uniformity of product is maintained. As a result of this cooperative effort, the quality of high-speed steels being produced today is definitely superior to the quality of steels produced only two or three years ago, and as a result of the steel mills' constant study of their operations, it is to be expected that the quality of the new material will continue to improve.

All tool steel manufacturers have their own brand names for their different grades of high-speed steels, and each brand has its standard chemical specification. The tool manufac-

Figs. 1 and 2—Two samples from a 4-7/32 in. round bar show the need for taking micro-sections from both ends of stock of this size. That of the left indicates satisfactory carbide distribution while that at the right has an undesirable cellular or chain-like arrangement



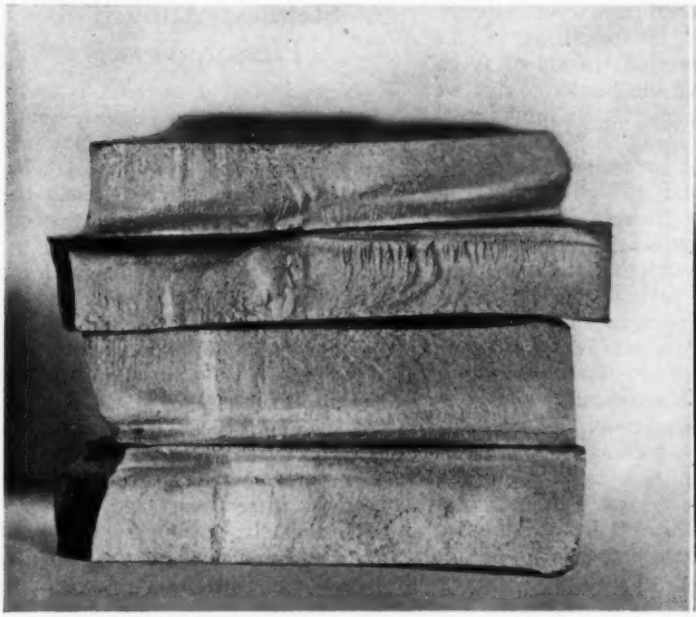


Fig. 3—Silvery streaks in the fractured samples of 2 in. rd. bar stock denote carbide segregations which may eventually cause breakage at the cutting edge Fig. 4—Laminations in these specimens cut from 2-in. rd. bar stock are an incipient source of cracks in heat-treatment or subsequent use

turer has found, as a result of his experience, that it is advantageous for him to maintain closer control of the chemical composition than is generally acceptable, resulting in the purchase of steel to closer than commercial limits. The mill either melts to the chemical specifications set by the tool manufacturer or picks a heat which analyzes within that specification, and by a well organized method of control in the mill, each shipment is tagged with the heat number and the mill supplies the analysis of the heat.

We do not analyze samples from each heat, as we rely on the analysis given by the mill as being correct. We are more particularly interested in the response of the material to a standardized heat-treatment and to an examination of the microstructure. We have a well equipped chemical laboratory and can conduct analyses when desired, but this is usually done on experimental work rather than as a general routine.

Standardized Inspection

When the material is received it is put through a standardized metallurgical inspection, the primary purpose of which is to determine its physical characteristics, uniformity and response to heat-treatment.

In the inspection of drill rod and cold-drawn steel, it is obviously impossible to check every bar due to the large number of bars per ton of material. We therefore take representative samples from each shipment or each heat, if there is more than one heat per shipment, and these samples are given a standardized heat-treatment, tested for hardness by means of the file or Rockwell, or both if large enough, and fractured to show fineness of grain and absence of internal defects. If the material passes this test, we then examine the sheared ends of the bars with a magnifying glass to detect possible seams or cracks. We have found that this type of defect is readily visible in the shear cut and easier detected by this method than by examining the surface of the bar.

The small sizes of hot-rolled bars are examined in a manner similar to the drill rod and cold drawn steel, but when we get into sizes above $\frac{1}{2}$ in. rd., disks are cut from both ends of the bar for hardened fracture examination. Over 2 in. rd. a microsection is taken from one end of each bar, which is done by cutting a triangular shaped piece, like a piece of pie, out of the disk. This piece is polished in a plane parallel to the longitudinal axis of the bar, etched, and examined under a microscope for carbide distribution. Above 3 in. in diameter, microsections from both ends of the bar are cut before the disks are hardened for fracture examination. The reason for double-disk inspecting the larger sizes and examining the microstructure at both ends of the bar is because the carbide distribution is controlled by the teeming practice and the amount of hot working or reduction from the ingot to the finished bar. Because of the physical chemistry of solidification, combined with the taper of the ingot, it is entirely possible to have two different types of carbide segregation at opposite ends of the same bar. Such a condition is shown in photomicrographs Nos. 1 and 2 which are the opposite ends of a bar of $4\frac{7}{32}$ in. rd. When a cellular or chain-like arrangement of the carbide is present, there is an inherent brittleness which cannot be removed by heat-treatment.

Carbide Streaks

The fractured disks are examined for grain refinement and any physical defects, such as carbide streaks, laminations, hair lines or slag inclusions. The photograph in Fig. 3 shows carbide streaks and the photograph in Fig. 4 shows what we call laminations" or "hair lines." This type of defect can occur any place across the section of the bar, as shown. It will be noted that the lower disk has a black streak near the center and another one just slightly below the surface at the left hand edge. The carbide streaks are the silver streaks, which usually occur near the center of the bar. Obviously it would be impossible to produce a satisfactory tool from material containing these defects. Photograph in Fig. 5 shows a tool which cracked after hardening and tempering as a result of a localized stress at a carbide streak occurring at the center of the tool adjacent to a hole.

It is impossible to inspect forgings in the same manner as described for bar stock. In order to effect a con-

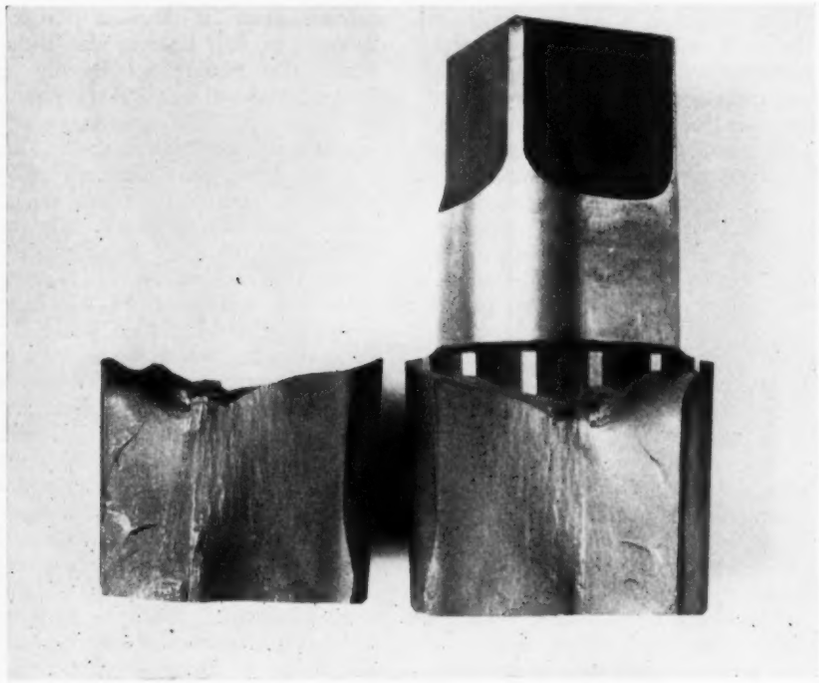
trol of the structure of the forgings used, we have instructed the mill as to what is desired in billet stock used for our forgings, and they disk inspect both ends of each billet, take microsections to determine the carbide distribution in the billet and examine the hardened fracture of the balance of the disk. They carry at all times approved billets for use in making our upset forgings. As a result of the increased hot-working of the steel structure, the resulting toughness of the forged cutter is superior to the toughness of a cutter made from bar stock, particularly in the larger sizes.

After the steel has been approved, it is placed in racks with suitable identification so that we know at all times the heat number and the analysis of the material applied individual orders, and this information is placed on the order at the time the material is applied.

The hardening room is equipped with modern furnaces, controlling instruments, and electric timers so that it is possible to maintain accurate control of the time-temperature cycle for the heat-treatment of all the tools. For standard stock tools, a standardized heat-treatment has been specified for each size and type of tool, and by controlling the raw material in the manner described above, and duplicate treatment, we are able to maintain a definite control of the finished tool so that a consistent performance results. A record is kept of the treatment of special tools which is supervised by the hardening-room superintendent and on repetition of the order, the previous treatment is recorded on the shop order so that we can again duplicate the results.

The hardening room force has been trained to follow instructions implicitly and to understand the metallurgical changes involved during heat-treatment. They are instructed to watch the tool as it comes up to heat, paying particular attention to the appearance of the cutting edges. The ideal tool is one that combines resistance to abrasive action of the chip with sufficient toughness to withstand edge crumbling or cracking, or tool breakage. Interrupted cutting tools, such as hobs or gear cutters, require great stamina. They must be hard and tough and the best control of these properties is effected by proper distribution of the extremely hard carbide segregate in a tough matrix. In addition to producing suitable cutting properties it is also necessary to control distortion and as a result of careful study, it is possible to preserve the correct form within close tolerances and avoid the barrel effect often found in cutters containing a large hole with respect to the diameter. The metallurgical department is continually investigating new materials and new heat-treating equipment. This, together with observation of the cutting tools at work in customers' plants, provides the background for a constantly improved product.

Fig. 5—A carbide streak near the center hole of this cutter was the cause of its failure, after hardening and tempering



Stainless Applied to Pressure Vessels

Nowadays if a material is badly needed, it is not long before someone develops or invents it. Nor is it long before the new material becomes a tonnage product. Such has been the case with stainless steels, the well-known steels containing 12 to 25 per cent chromium with or without up to 10 per cent nickel. As pointed out by J. C. Holmberg, of the Struthers Wells-Titusville Corporation, in a symposium on the welding of high-alloy steels, none of the stainless steels was known at the opening of the twentieth century, and many had not been conceived as early as fifteen years ago.

Fortunately, welding had been growing and becoming a popular means of fabricating during this same period. It is not surprising that this method of making joints was rapidly adopted for many successful installations which could never have been built by other methods. Especially is this true in the food, rayon and other chemical industries in which tanks, mixers, towers, pots and other equipment must be resistant to corrosion, proof against leaks and free from crevices where food may lodge and ferment.

Of the many examples of welded stainless steel products cited by Mr. Holmberg perhaps the most interesting is the combination rail and truck milk tank. The inside of the tank is stainless steel which is covered first with heat insulation and then with sheets of mild steel. The interior must take a sanitary polish, including the welds in which depressions or pores are inadmissible.

Another instance is a welded stainless steel vulcanizer for motor car steering wheels. Made of 18-8 (18 chromium, 8 nickel) $\frac{1}{2}$-in. thick and 50 in. diameter, 18 ft. long, the vulcanizer cost $10,000, whereas the same apparatus made of mild steel would have cost only $2,000. The product from the stainless vulcanizer, however, is not rust stained as would be the case with a vulcanizer made of ordinary steel.

A most unusual application of welded stainless steel described by Mr. Holmberg is an X-ray machine for the treatment of cancer built for Columbia University and the Presbyterian Hospital, New York. Stainless was selected because its greater density assures successful operation of this high-vacuum apparatus.

From a paper presented before the eighteenth annual meeting of the American Welding Society.

Booth Equipment for Coated Rod Welding

A controlled air current will carry away fumes and curtail the silica count behind the welder's mask

C. C. HERMANN

"DO NOT WATCH THE ARC" is a warning commonly found on guards used by welders. It is intended for the protection of the eyes of the passerby as well as those of the welder. It would be good advice if "Do not breathe the fumes" were added, for in the curling smoke lies a danger not readily appreciated. Many devices have been designed to give the welder needed protection. Air streams have been directed toward the vicinity of the welder and various portable ventilating systems have been designed to carry away the fumes and make welding a safe occupation, because it has been found that breathing the fumes causes a fever.

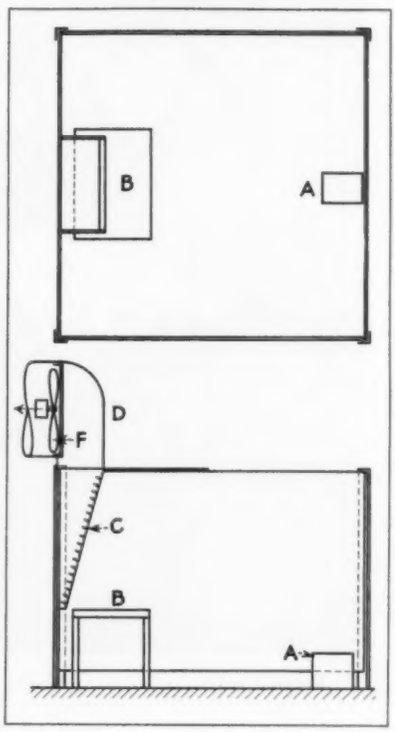
With the advent of the coated welding rod another condition has been introduced, that of silica dust. Recent tests conducted in electric welding inclosures show that the silica percentage may run as high as 15 to 18 per cent. The covering on some commercial rods is 11 per cent silica. In addition to being subjected to the possibility of metal-fume fever, the welder is subjected to the silica-dust hazard unless precautions have been taken properly to ventilate the work area.

Dust Count Cut

In one instance where dust counts were made in welding booths, the count prior to installation of ventilating equipment was 178,500,000 particles per cu. ft. of air for the normal atmosphere and 210,000,000 particles per cu. ft. behind the welder's mask. Following the installation of adequate ventilating equipment, the general atmosphere showed 7,000,000 particles per cu. ft. of air, and behind the welder's mask the count was 8,300,000. The silica showed 11.1 per cent, therefore the initial condition showed 19,600,000 silica before and 780,000 after for the general atmosphere and a reduction from 23,100,000 to 830,000 silica behind the welder's mask. The counts were based on particles 10 microns long or under in longest dimension.

There are many things to be considered in effectively ventilating a welding inclosure. The size of the inclosure should be reduced as much as possible without interfering with the comfort of the welder, but sufficient space should be provided to allow the work to proceed unhindered. The lighting arrangement must be adequate, otherwise the welder will permit the entrance curtains or doors to remain open, thus destroying the effect of the ventilating system.

General application of ventilation to a welding booth. The direction of air flow is toward the exhaust hood *C*, which is connected by the exhaust duct *D* to the fan



The direction of the air and the value of its velocity must be such as will sweep the fumes directly away from the head of the welder. This requirement is often difficult to meet, because of the necessity of performing numerous types of welding in the same booth. For production welding where the operation is continuous on duplicate parts, the task is very much simplified. The air velocity in the direction of the exhaust duct should be from 200 to 300 ft. per minute.

Exhaust Head Location

Wherever possible the exhaust head should be placed over the welding zone and as close to the point of welding as possible, because the vertical convection of currents will be of assistance to ventilation instead of a hindrance, as when trying to draw the gases in a direction at a right angle to the normal convection current. It is appreciated, of course, that in order properly to observe his operations and perform suitable work, the welder must have adequate vision. That means that he must get his guarded head as close to the work as possible to see the flow of metal. It is apparent that in this position he will be subject to considerable dust-laden atmosphere which will get behind his mask, and that accounts for the high dust

counts observed. High velocity jets of air cannot be directly directed on the welding metal, but moderate velocities in the order of 200 ft. per min. can be used.

The hood of the exhaust system must be placed as close as possible to the point of welding because the effect of air velocity varies as the square of the distance between the face of the hood and the welding point. A study of the fume path will be of material assistance in designing the hood and finding its location. No set formula can be given for hood design, as practically no two jobs will have the same requirements. The general feature of hood design must be applied with the idea uppermost in mind of utilizing the directional energy of the fume stream.

In the illustration is shown a general application of ventilation to a welding booth. General in the sense that the product welded varies from day to day, which is the common condition in most shops. To depend upon the welder to change hoods to secure the maximum benefits is not always practicable, although very desirable.

Referring to the illustration, the booth equipment consists of the generator *A*; the welding table *B*; the exhaust hood *C*; the exhaust duct *D*; and the exhaust fan *F*. The motor generator or d.c. welder is provided with a fan on the rotor which may be utilized to advantage in assisting the ventilation scheme. For that reason it is placed behind the welder, the direction of the air flow being in the general direction of the exhaust hood.

The welding table on which the work is placed is in this case 30 in. high. It is placed directly in front of and below the exhaust hood, which is connected by the exhaust duct to the exhaust fan. The exhaust from the fan is high enough to permit complete dispersion of the dust into the outside atmosphere, unless conditions in the vicinity or the releasing of the exhaust require other methods of disposal, or even cleaning the exhaust before liberating it to the outside atmosphere.

The exhaust hood in this instance is in the form of a rectangle having a louvered face. It slants somewhat forward to overhang the work being welded, therefore utilizing so far as possible the directional energy of the fume stream, the velocity of which is 200 ft. per min. at the duct entrance. The area being 12 sq. ft., the volume of air removed is 2,400 cu. ft. per min. The inlet area to the booth is 50 sq. ft. over the top, one-half of the top being open, and 5 sq. ft. at the bottom of each side and at the end opposite the exhaust hood. The total area is therefore 65 sq. ft., giving a velocity of inlet air of nearly 37 ft. per minute.

Smoother Surfaces by Electronics

INDUSTRY'S search for smoother surfaces, or ones with better characteristics for the applications involved, is exemplified by the program undertaken by the Chrysler Division, Chrysler Corporation. Lapping and polishing processes have been improved through studies made possible by the Profilometer, an instrument developed by the Physicists Research Laboratory. This device measures the contours of the surface; different abrasives and abrasive tools have been tried out, the results measured and technique in the shops improved. Experiments carried out for a half dozen or more of the principal engine components have established an average improvement of over 500 per cent in the quality of the surfaces.

The Profilometer runs an extremely fine diamond point over the surface, and vertical movement of the point excites a minute coil. The extremely small voltage thus produced is amplified by electronic means. For experimental purposes the voltage is then passed through a cathode-ray oscillograph and the trace recorded photographically. For inspection of parts produced on the production line a meter and hand tracer are substituted as shown. The voltage then actuates the meter and the operator reads the depth of the scratches on the piece directly in micro-inches.

A small tracer is passed over the surface and a meter shows the depths of scratches in millionths of an inch

TALKING SHOP

Second Year Skill

A shop superintendent who wished to measure the progress of his apprentices hit upon the plan of checking their performance in production departments against the standard times used by experienced workmen. The method used was to set up a card for each apprentice and post actual time against standard time on each job, marking the difference in red when there was an overrun.

The result was startling. One sec-

ond year apprentice did not exceed the allowed time for a whole year; another ran over the standard only once and that was during his first week on production work. The average for all apprentices was actually better than that for the older workers.

The super attributes this showing to the fact that the boys have nothing to unlearn. They soak up new knowledge like sponges and put it to work with a will.

Where Belts Belong

Although there are well over 20 million automobiles in this country, the horse has by no means gone into the discard. It is still an important factor in many fields and will continue to be. In a somewhat similar manner the use of belts still plays an important part in driving machinery in spite of the use of individual motors on many machines, both large and small.

The outlook is, according to a very practical production manager, that the use of belting will continue for many years, and for two reasons.

First—there are thousands of belt driven machines in the shops of the country that will not be discarded for some time. Neither will they be motorized, on account of the cost.

Second—there are many cases where the grouping of small machines driven from a single motor is much more economical. This refers not only to first cost but to operating expense as well. There are, of course, cases where small individual motors are justified, but group driving still has a distinct field of its own.

New Job for Race Drivers

The builder of an ultra-high-speed strip-steel mill told us the other day about the trouble the buyer of one of his new mills had to get men to handle it. The strips came through so fast they couldn't get any steel mill men to run it at more than half speed. The men were afraid of it because it was so much faster than the old mills.

Someone got the bright idea of trying to get men who were accustomed to things that moved

rapidly. They decided to see if they could hire race drivers such as haunt the track at Indianapolis, and take any old job between races.

It worked; so did the mill. And, having shown the steel men that the mill was O.K. at full speed, there was no further trouble with production.

Showing Up a Foreman

Suggestion boxes yield many varied results. They should not be installed unless some one in authority will devote sufficient time to consider the suggestions carefully. Properly used they promote better understanding between men and executives. In one case recently the suggestion box showed up one of the foremen, quite innocently on the part of the suggestor. He proposed a method of handling shop orders that had been adopted by the firm some months before. His "suggestion" showed the brass hats that one foreman at least had paid no attention to the order. It took some tall explaining on the part of the foreman to square himself, not only with the boss but with his men.

Taxes and Profits

There was a time when business men and professors of economics proclaimed that the object of a business enterprise was to make profits. Then arose certain thoughtful citi-

zens who insisted that the function of a business was to render a service, and that profits followed in due course if the service was worthwhile.

But those days and the quaint ideas that flourished then are gone. Today the tax collector comes first. If there are any profits left after that the proprietor and his stockholders may have something—or they may not.

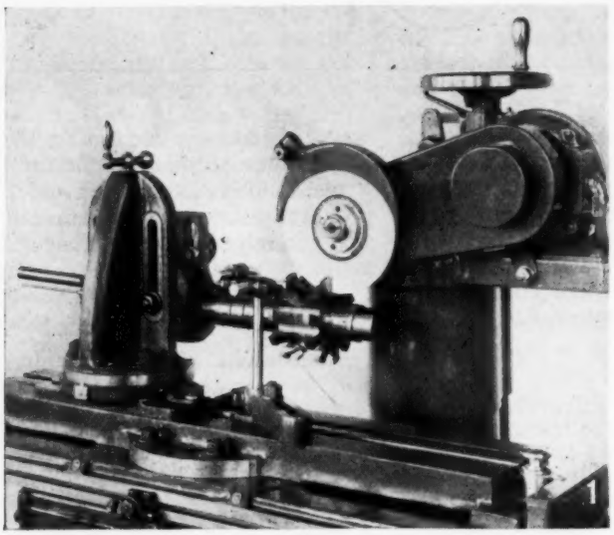
Take the case of an old and respected builder of intricate machines. For the six years from 1931 to 1937—three good years and three bad ones—he made profits of $43,000 and paid federal taxes of $195,000. For whom was he working?

Move Your Presses, Mister

With the increased use of stampings and press work in the automotive industry the problem of arranging presses to insure smooth production flow became a difficult one. One of the large Detroit manufacturers is solving the problem in its new press shop by laying down a concrete mat of uniform thickness and to such depth that the presses may be moved anywhere on the floor to suit production requirements. Initial cost may be high but the savings in always being able to arrange a good production line will offset that.

The Editors.

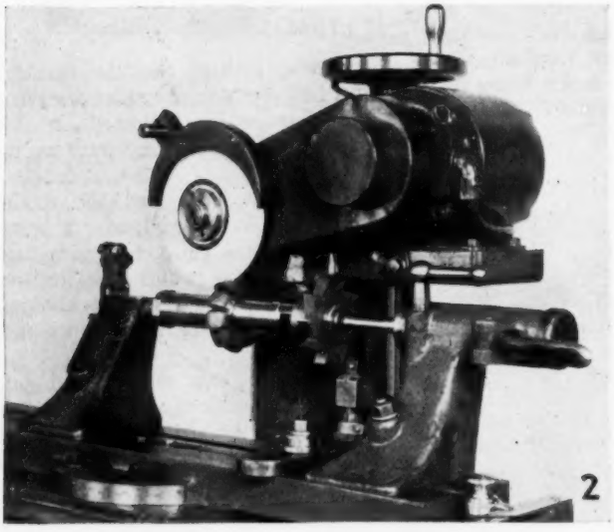
Typical Cutter



1. WIDE-FACED FORMED CUTTER USING A UNIVERSAL HEAD. The cutter is mounted on an arbor and is passed across the grinding wheel by traversing the table by hand. A bevel and concave wheel is used.

The tooth rest is shown bearing on the backs of the cutter teeth. To insure correct spacing, this practice necessitates first grinding the backs of the teeth. This may be done on index centers, or the cutter may be mounted in the universal head, as shown above, but in the reverse position, using the tooth rest on the faces of the teeth while grinding the backs

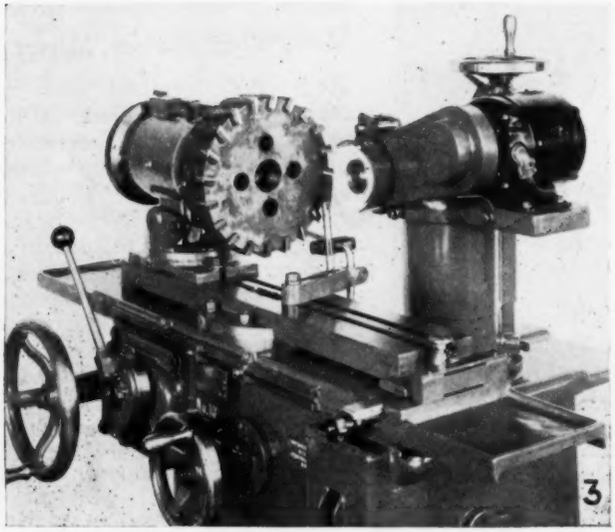
2. EASILY-MADE SPECIAL EQUIPMENT FOR SHARPENING FORMED CUTTER. The cutter is held on an arbor between centers and is indexed by means of a special index wheel mounted on the same arbor. The tooth rest for the index wheel has a screw adjustment to provide for rotation of the cutter to feed it to the wheel. The diamond tool supported on the center head provides an easy means for truing the wheel, and serves to locate the wheel transversely in order that the face of the cutter shall be ground radially

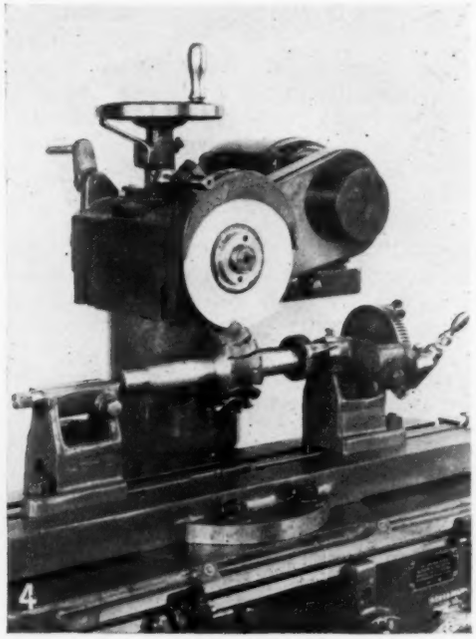


3. PERIPHERY OF THE TEETH OF LARGE FACE MILLING CUTTER. Either solid or inserted-tooth side or face milling cutters which are too large in diameter to swing over the machine table when mounted on the centers, can be sharpened by the use of an attachment.

To maintain the proper tooth shape, the body of the attachment is swiveled in a vertical plane so that the edge of the tooth being sharpened will be horizontal. With the aid of the 15-deg. clearance setting scale provided on the attachment, the tooth rest is adjusted as when sharpening a plain milling cutter. Sides and corners of the teeth can be sharpened by swiveling the attachment

4. WIDE-FACED FORMED CUTTER ON THE INDEX CENTERS. The cutter is placed on an arbor and mounted on the index centers as shown above. A bevel and concave (dished) wheel is used. and the wheel is positioned so that the plane of the grinding face passes through the exact center





* From an instruction book on tool and cutter grinding about to be published by the Brown & Sharpe Manufacturing Company.

Grinding Set-Ups

of the cutter, thus assuring that the face of the tooth will be radial, as is required to preserve the tooth profile.

The row of holes in the index plate corresponding to the number of teeth in the cutter is selected. As a precauton to prevent backlash and reduce error in indexing, the tooth to be ground should be indexed toward the cutting face of the grinding wheel

5. END TEETH OF A SPIRAL END MILL. Using a cupped wheel, the wheel spindle column and the upright of the universal head are set at 90 deg., the table being set at zero. Clearance is obtained by swiveling the universal head in the vertical plane to the desired angle of clearance. The tooth rest is set so that the edge of the tooth will be horizontal

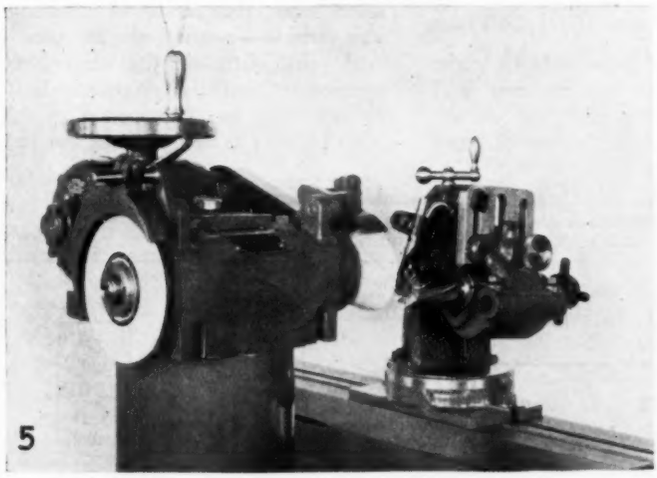
6. STEEP-ANGLE HELICAL MILLING CUTTER. The cupped wheel is so formed that the cut will be made only by the outside (or the inside) edge of the cutting surface of the wheel; and the wheel column is swiveled very slightly from the 90-deg. setting so that the back edge of the wheel will just clear the cutter.

7. PERIPHERY OF TEETH OF STAGGERED TOOTH MILLING CUTTER. The cutter is placed on a sliding sheel and mounted on the cutter bar set in the universal head. The tooth rest is clamped to the wheel column and is shaped to a double angle, the angles being equal to or somewhat greater than the angles of spiral (helix) of the cutter teeth. The clearance is obtained by setting the tooth rest the proper distance below the center of the cutter.

The teeth are ground by sliding the cutter on the cutter bar with the spiral edge of the tooth resting on the corresponding angle of the tooth rest

8. DOUBLE ANGULAR CUTTER. The table is shown swiveled to the required angle for one side of the cutter. The reading is taken from the graduations on the arc at the front. After one side is ground, the table is swiveled for the opposite side.

The universal head may be swiveled instead of the table for obtaining the angle. In that case, the tooth rest should be clamped to the front of the head rather than to the table as shown here, so that it will shift with the work. This job could also be set up between centers in cases where the footstock would not interfere with the swiveling of the table for the required angle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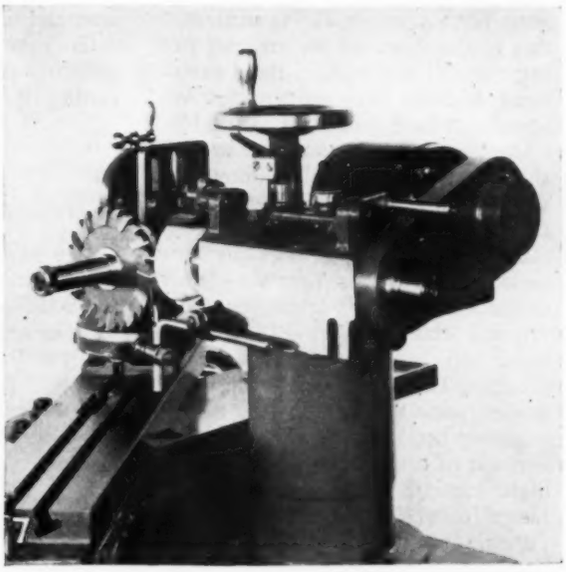
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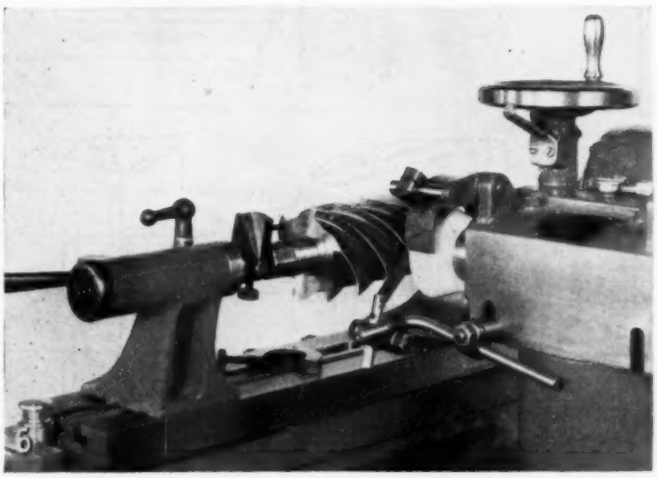
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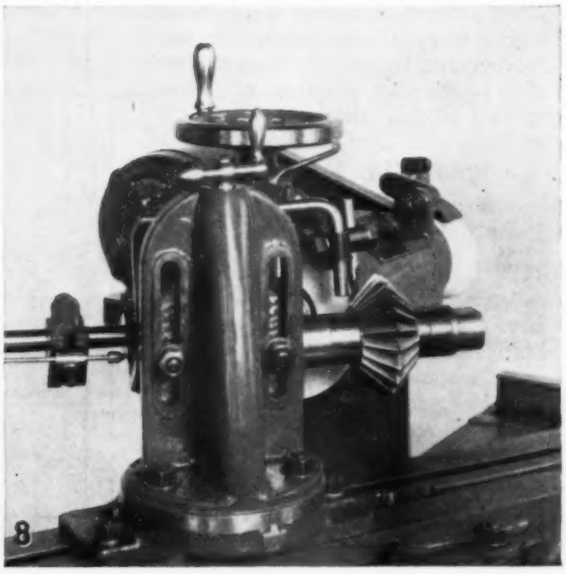
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Current Practice in Chip Control

III—The same chip breaker is not applicable to all turning and boring jobs; each set of conditions must have separate consideration

NOT LONG ago a tool engineer told us that he has been able to form three or four types of chip with the same tool when cutting the same piece of material. He attributed this to variations in the material being cut and the relation these variations had to the combination of speed and feed being used. In addition, very slight variations in the shape and depth of the groove he was using in his tool bit would cause entirely different chips to form.

As pointed out in previous sections of this symposium, the depth of cut, feed per revolution and physical characteristics of the material will greatly affect the form of the chip. These factors, in turn, serve to determine the form of the necessary chip breaker. Where no attempt is made to control the chip, modern high turning speeds, which often range from 200 to 350 surface feet per min., or more, cause the formation of long straight chips that shoot out from the tool and entwine themselves around the nearest object. This makes it practically impossible for the operator to control the machine and forces the adoption of some method of chip control.

J. EARLE MAKANT
Assistant Manager of Sales
Potter & Johnston Machine Company

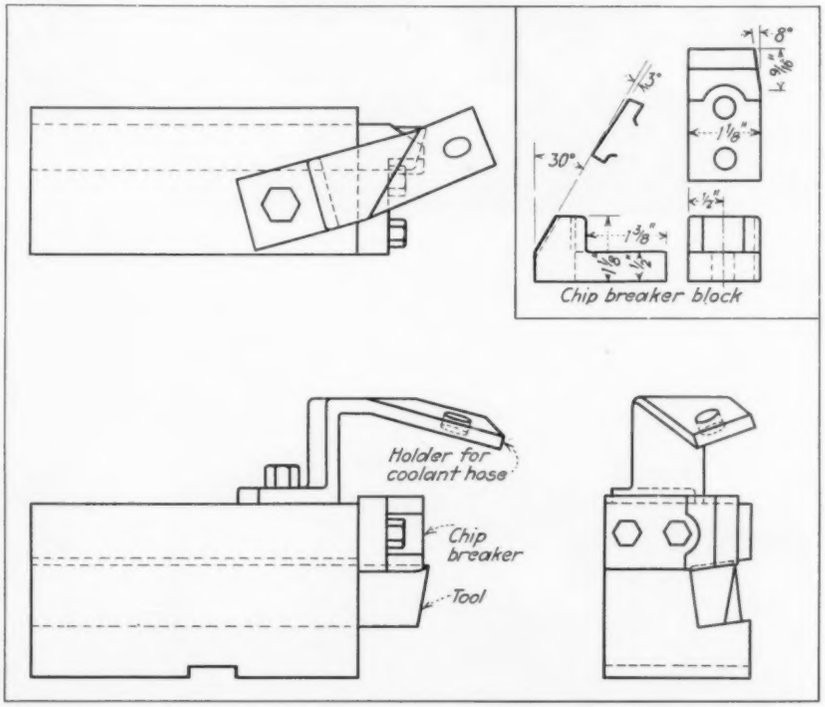
With the use of high-speed and cobalt steels as cutting mediums on steel forgings and castings, we have been able to obtain satisfactory results, without danger to the operator, by grinding the proper rake the single-point tool; to date we have Our multiple-type tooling offers an entirely different problem than does the single-point tool; to date we have hesitated to employ tungsten-carbide tipped tools when machining steel parts. We have tooled a large number of machines with tungsten-carbide tipped tools for cutting cast iron and, in all cases, satisfactory results have been obtained by the grinding of the proper rake on the cutting tip.

T. B. BUELL
Sales Manager
Sundstrand Machine Tool Company

We have not been able to make a standard chip breaker that will work on all lathe jobs, but we are fully in accord with the use of some method of breaking up chips. When chip breakers are required, they usually must be worked out for the job with which they are to be used. Certain principles can be used, but from our experience condition of the chips, such as the depth of cut, feed per revolution and hardness of material, will greatly affect the correct shape of the breaker. We are not in favor of grooving the top of lathe tools, particularly when tungsten-carbide tipped tools are used.

A chip breaker that has been applied successfully for cutting heat-treated steel is shown in Fig. 12. This breaker is mounted on the face

Fig. 12—The chip breaker recommended by Sundstrand Machine Tool Company is mounted above the tool so as to bend and break the chip as it leaves the cutting edge



of the tool-holder block in such a manner as to bring the angle of the breaker directly behind the cutting edge of the tool. It is made of tool steel and is heat-treated to 90-95 Scleroscope. This breaker causes the chip to bend sharply and break as it leaves the tool edge.

H. C. PIERLE

Vice-President & Sales Manager
The R. K. LeBlond
Machine Tool Company

We have tried out a number of different kinds of breakers that clamp on the top of tools so as to break the chips as they come from the cutting edge. The major trouble experienced with this type of chip breaker was that the finer chips would wedge themselves between the tool and breaker and finally force the breaker off the tool.

The only successful chip breaker that we have seen or used is a lip ground directly in the tool, even this will last for only a certain length of time, until craters are formed behind the cutting edge of the tool and the chip starts coming off in a long helix.

H. CRUMP

Works Laboratory
General Electric Company
Schenectady Works

We have found that the most successful form of chip breaker for all "straight" boring, turning and facing jobs, where the job is large enough to permit the use of the tool holder is the combined tool-bit holder and chip breaker shown in Fig. 13. This holder permits the use of high-speed-steel or tungsten-carbide bits ranging from 5/16- to 1-in. square.

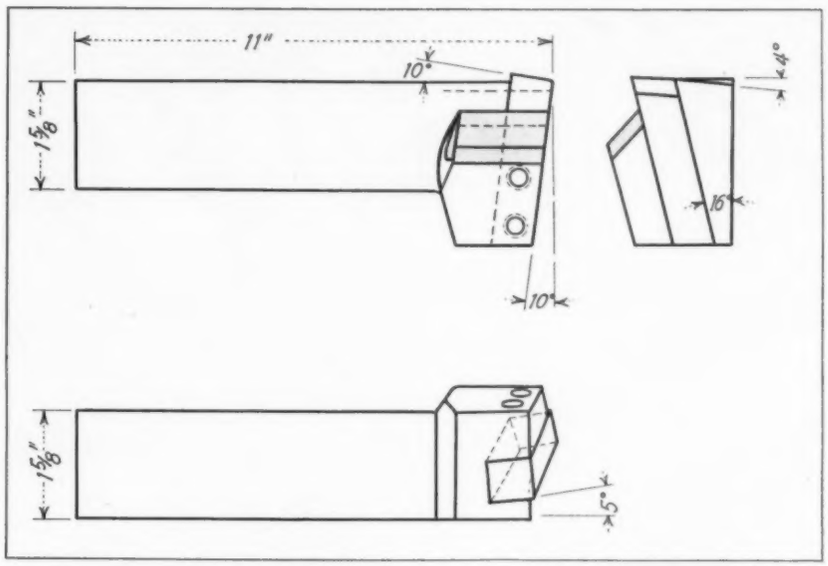


Fig. 13—Where clearance permits its use, the combination tool-bit holder and chip-breaker has proven efficient. Tool-bits are used without grinding for top or side rake

Tool-bits are mounted in the holder at an angle that eliminates the need for grinding top- or side-rake angles on the bit. The bit is adjusted in the holder so that the point is in proper relation to the centerline of the work.

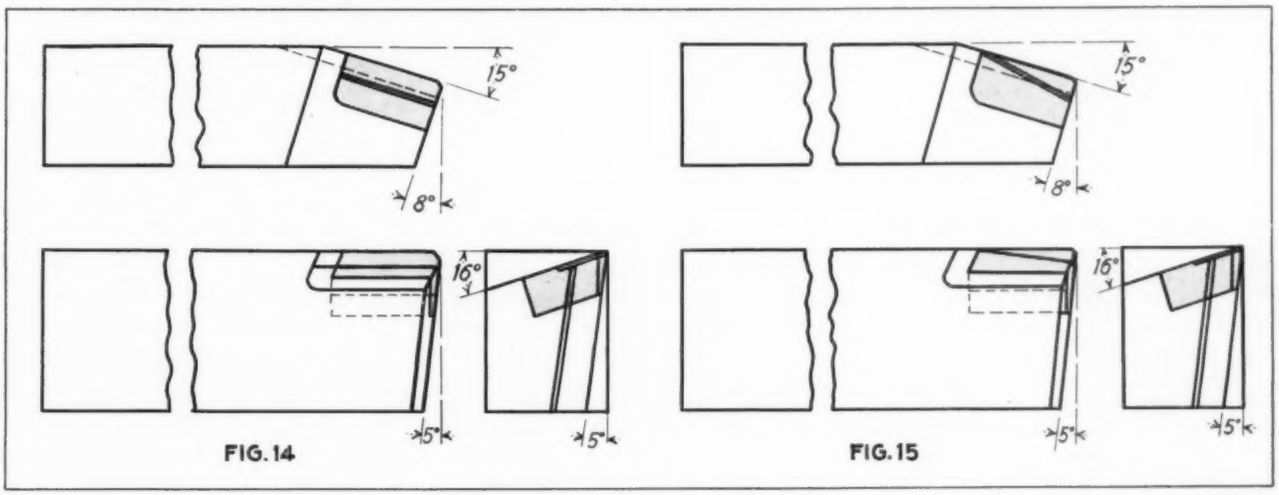
A "Carboloy" block is brazed in position on the holder in proper angular relation to the tool-bit position so that the chip is deflected by the block and is caused to curl and break off at short intervals. Size of the chip curl is also governed by the distance the cutting-edge of the tool-bit is projected from the breaker-block. For example, if the tool-bit is projected about $\frac{1}{8}$ in., the result will be a very short chip curl. However, if the bit projects $\frac{5}{8}$ in. a curl approximately 3-in. in diameter can be expected.

We have used these tool holder-chip breakers on lathes and boring mills and have taken varying depths of cut at different rates of feed, combinations ranging from a 1/16-in. deep cut with a 0.005-in. feed per rev. to a 1-in. deep cut with a 0.125-in. feed per rev. Experience has proven that heavier cuts are best taken at higher speeds and lower rates of feed.

Another form of chip breaker being used successfully is the grinding of a chip-curler in the tool-tip itself. This is done on all types of tools having shanks ranging from $\frac{1}{4}$-in. square to $1\frac{3}{4} \times 2\frac{1}{2}$ in. These tools are used for the smaller in-

Fig. 14—Chip-breaker grooves are ground in tipped tools by the Schenectady Works of General Electric Company for both boring and turning operations

Fig. 15—Flow of chips can be controlled by changing the angular relation of the chip-breaker groove with the cutting edge of the tool



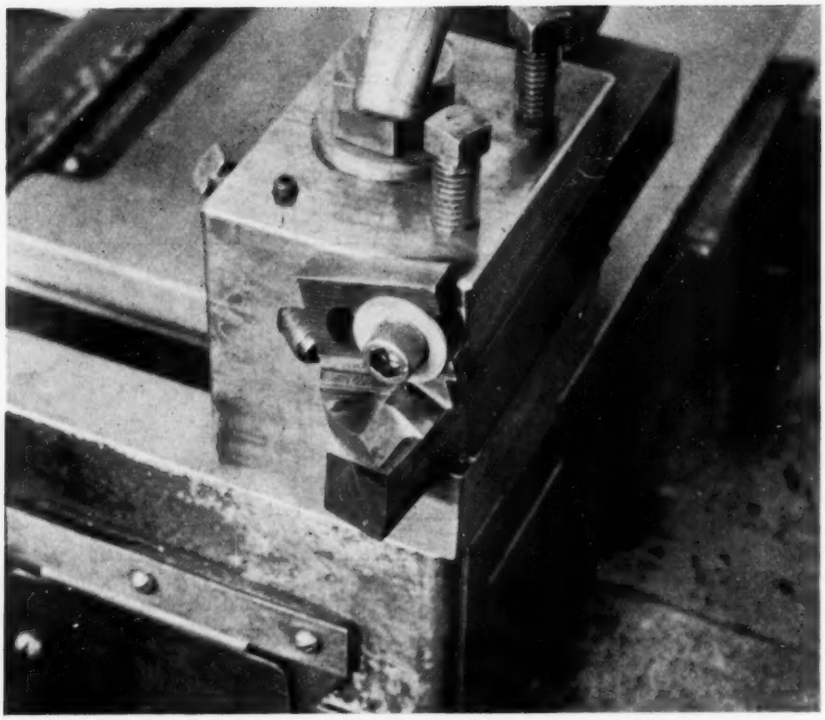


Fig.—A cover-type breaker, developed at the Lynn Works of General Electric Company, is used for such operations as shaft turning where production quantities are large and clearance permits

ternal boring jobs and for turning and boring on the largest lathes and boring mills.

A typical tool of this type is shown in Fig. 14. The angle at which the breaker-groove is ground in the tool is usually parallel to the cutting edge. We have found that it is best not to grind the depression in the top of the tool more than 1/16-in. deep, in most cases the best depth is less than that.

Groove Size Varied

Width of the depression depends on the size of the job, on the depth of cut and feed to be used and on the size of chip curl desired. For instance, a 1½-in. square tool used on an 8-ft. boring mill would have the groove ground ¼-in. wide from the cutting edge.

We have found, in some cases, that degree of angle ground in the top of the tool changes the flow of chips. It is often desirable to change the direction of this flow in order to divert the chips away from the work, as in the case of a shaft-turning operation on a lathe. If the chip can be directed away from the work there is less chance of scoring or "roughing up" the part already machined. This can be accomplished by grinding the groove at an angle with the cutting edge, as in Fig. 15. For example, starting at approximately ⅜ in. from the cutting edge at the point of the tool and running back on the cutting edge, forming a triangular shaped breaker on the top of the tool.

For cut-off or parting tools, we grind the top face with a small radius at right angles to the cutting face. The size of the correct radius varies with the material being machined. In the case of bronze and brass this radius does not have to be very large, approximately ¼ in. maximum. However, in the case of steel we have found it best to have a larger radius, not quite so deep, extending back from the cutting edge so as to throw a larger chip curl. For parting tools, these radiuses are not brought directly to the cutting edge. A land ranging from 0.0010 in. to 1/32 in., depending on the size and type of material, gives best results.

K. A. MUNSON
General Manufacturing Department
General Electric Company
Lynn Works

We have found the combination tool-bit holder and chip-breaker, Fig. 13, too large for many applications. The practice of grinding a breaker-groove in the tool-tip has had much practical application in the Lynn Works. We use slight modifications of this method extensively. While it increases the cost of grinding and re-grinding and reduces the effective utilization per unit of volume of cemented-carbide tip, it is undoubtedly the most widely applicable method of chip control.

For some semi-special operations we have developed a cover-type chip breaker which, in some cases, is attached to the top of the tool shank or, in other cases, is clamped by the tool post. This breaker, shown in Fig. 16, lays on the top cutting face of the tool and curls or breaks the chip in much the same manner as the combination unit shown in Fig. 13. Radius of curl is varied by adjusting the cover toward or away from the tool edge.

GEORGE M. CLASS
Gisholt Machine Company

We have never developed a standard breaker which has been found suitable for all purposes. Grinding a groove directly behind the cutting edge of a turning tool is the best method for rolling and breaking chips when the material is such that it is easily broken. The size of this groove depends upon the feed and the speed being used, also on the depth of cut. It varies with each different grade of steel being turned and, in some cases, such as the high alloy steels which are very hard to break, will not work at all.

Variables Considered

Standard groove dimensions have not been developed since there are so many things to take into consideration for any particular application. In practically all cases, this groove starts about 1/32-in. behind the cutting edge and varies from 1/16- to 3/16-in. wide over the top. In the case of the high-alloy steels, where it is difficult to break the chips, we control the rolling of the chips to a diameter suitable for easy handling and then direct it to such a position that it will fall in the chip pocket provided in our machines.

Another factor affecting the groove is the type of tool being used. Grooves suitable for high-speed steel tools are of different dimensions than those best suited for tools tipped with Stellite or one of the carbide materials. Some grooves can be ground rather deep and will aid the cutting edge of the tool. Other grooves must be shallow in order to protect the cutting edge. When using a fairly heavy feed, of about 1/32-in. per rev. and coarser, chips will break automatically. It is on the finer feeds that we have experienced most of our difficulty.

A New Inch

Proposed legislation now before Congress would give official sanction to present practice and permit the use of light waves in determining the standard

H. W. BEARCE
Co-Chief, Division of Weights and Measures
National Bureau of Standards

THE BILL designated as H. R. 8974, now pending before Congress, is of interest to all who are in any way concerned with precision measurements. That includes most of us. We should, therefore, make a careful study of the pending bill to learn what it contains and what its enactment may be expected to accomplish.

The first three sections are here given in full, Section 3 having been revised to include a definition of the United States inch in terms of cadmium light waves. The bill comprises ten sections each of which has a specific purpose. Section 1 sets up the meter as a legal unit of length and defines that unit. Section 2 sets up the United States inch as a legal unit of length and defines it in terms of the unit (the meter) defined in Section 1. Section 3 sets up a primary physical standard in terms of which the units defined in Sections 1 and 2 shall be basically expressed. Section 3 also provides that it shall be legal to use for standardization purposes certain relations in defining the units, the meter and the inch, in terms of wave-length of the red radiation from cadmium, under specified standard conditions:

(a) The wave-length of the red radiation for cadmium = 6,438.4696 x 10^{-10} meter.

(b) 1 meter = 1,553,164.13 cadmium wave-lengths

(c) 1 U. S. inch = 39,450.369 cadmium wave-lengths

under the same specified conditions. Sections 4 to 10 inclusive have to do with units and standards of mass, the kilogram, the U. S. avoirdupois pound, the U. S. troy ounce, the U. S. apothecaries' ounce and the carat, and with units of capacity, the U. S. gallon, the U. S. bushel, and the liter.

The bill has nothing to do with

A BILL to define certain units and to fix the standards of weights and measures of the United States

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that the meter adopted by Congress July 28, 1866 (U.S.C., title 15, ch. 6, sec. 205), as a legal unit of length shall be defined as the distance, at zero centigrade between the axes of two median lines engraved upon the bar of platinum-iridium deposited in the International Bureau of Weights and Measures, and declared to be the international prototype of the meter by the First General Conference on Weights and Measures, this bar being subjected to normal atmospheric pressure and supported by two rollers not less than a centimeter in diameter situated symmetrically in the same horizontal plane and at a distance of five hundred seventy-one (571) millimeters the one from the other.

Sec. 2. That the United States inch shall be a legal unit of length defined as the distance comprising two hundred fifty-four ten thousandth parts (0.0254) of the distance defined as the meter.

Sec. 3. That the United States primary standard for the determination of the legal units of length, the meter and the inch, from which all other legal units or measures of extension, whether linear, superficial, or solid, and all legal units of capacity, except as otherwise provided herein, shall be derived and ascertained shall be the platinum-iridium bar known as National Prototype Meter Number 27, which was received by the United States from the International Bureau of Weights and Measures in 1890, and which is now in the custody of the National Bureau of Standards. The length of the graduated interval on the bar shall be the value certified by the International Bureau of Weights and Measures: Provided, however, that it shall also be legal to use for standardization purposes the following relations: (a) The wave length of the red radiation from cadmium equals six thousand four hundred thirty-eight and four thousand six hundred ninety-six ten-thousands times ten to the minus tenth power ($6438.4696 \times 10^{-10}$) meter, in air having an index of refraction of one and twenty-seven thousand six hundred forty hundred-millionths (1,00027640), using a cadmium lamp under standard conditions as specified by the International Committee of Weights and Measures; (b) one meter equals one million five hundred fifty-three thousand one hundred sixty-four and thirteen one-hundredths (1553164.13) wave lengths of the red radiation from cadmium, under the same specified conditions, these values being those provisionally approved by the Seventh General Conference on Weights and Measures, held in 1927, and published in Comptes Rendus des Séances de la Septiéme Conference Générale des Poids et Mesures; and (c) one inch equals thirty-nine thousand four hundred fifth and three hundred sixty-nine thousandths (39450.369) wave-legths of the red radiation from cadmium under the same specified conditions.

the "metric controversy"; it seeks in no way, either directly or indirectly, to encourage or to make compulsory the use of the metric system of weights and measures in the United States. The purpose of the bill, as set forth in the title, is to define certain units and to fix the standard of weights and measures of the United States.

Reverting to Sections 1, 2 and 3, with which we are particularly concerned, an important distinction must be made between a *unit* and a *standard*. In Section 1, the unit, the meter, is defined. In Section 2 the unit, the U. S. inch, is defined. In Section 3 means are provided for realizing these units in the form of physical standards. That is, the standards set up in Section 3 are the physical embodiments of the units defined in Sections 1 and 2.

In Section 3 it is provided that the primary standard in which shall be embodied the units of length, the meter and the inch, and from which shall be derived all other units or measures of extension, whether linear, superficial, or solid, and all legal units of capacity, except as otherwise provided in the bill, shall be the platinum-iridium bar known as National Prototype Meter No. 27.

What Standard?

It may well be asked why that particular bar, National Prototype Meter No. 27, is selected as the primary standard of length for the United States. Why, for example, do we not set up our primary standard in terms of cadmium light waves, or why not adopt as our primary standard, the primary standard yard bar of Great Britain?

The answer, in regard to the setting up of our primary standard of length in terms of cadmium light waves, is that it is not believed that the time is yet ripe for so radical a step. In the meantime provision is made for the legal use of cadmium light waves in all cases in which such use is advantageous. The answer, in regard to the British Imperial Yard, is that it would seem very unwise for this country to adopt a standard over which we could have no control and to which we could not have ready accessibility.

A further and important reason for adopting National Prototype Meter No. 27 as our primary standard is its known reliability. Over a period of nearly 50 years that standard has maintained its length without measurable change. Through the functioning of the International Committee and the International Bureau of Weights and Measures, its length in terms of the International Standard, and in comparison with a large number of other similar standards, is known to a high degree of accuracy. To discard it at this time would be to throw away 50 years of world experience in precision length measurement.

By accepting National Prototype Meter No. 27 as our primary standard, and by the enactment of Section Y2 of the pending bill, we are giving to the United States inch the firmest background of stability and constancy that it is possible to give it at the present time. In that way the U. S. inch will for the first time be placed on an equal footing with the meter. Its value will be fixed and its future secure.

The enactment of Section 2 of the pending bill would give official recognition to the relation between the inch and the millimeter, namely, 1 inch = 25.4 millimeters, exactly. This has already been adopted by standardizing bodies and by industry in some seventeen countries including England and the United States. This is unquestionably one of the most important provisions of the bill. A further question that may arise regarding the pending bill is: What changes, if any, in our present units will result from its enactment?

The present U. S. inch, as derived from the law of 1866, expressed in millimeters, is equivalent to 25.4000508 +. From Section 2 of the pending bill, 1 U. S. in. = 0.0254 meter, or 25.4 millimeters, exactly. Thus the enactment of the pending bill would result in shortening the U. S. inch by one part in 500,000, or two parts in 1,000,000. In other words, the U. S. inch would be shortened by 0.000002 in.

This change is, of course, of no significance except in measurements of the highest precision. It is of importance in the manufacture and calibration of precision gage blocks and line standards, and in the calibration of certain limit gages used in high precision interchangeable manufacture. Other units derived from the inch such, for example, as the U. S. gallon and the U. S. bushel, would be decreased in size in corresponding proportion. These changes would be entirely without significance. Our units and standards of mass would not be affected in any way by the enactment of the bill.

It has sometimes been stated, or implied, that enactment of the pending bill would bring about a difference, or would increase the present difference between the U. S. inch and the British inch. Such is not the case. It would reduce the difference between the U. S. and the British inch to about a third of its present value. This, in itself, would be desirable, We may even be justified in expressing the hope that England, following our example, may take the necessary action to eliminate the small remaining difference.

Publication approved by the Director, National Bureau of Standards of the Department of Commerce.

A Lesson in Hardening

J. HOMEWOOD

Old Bill was preparing the forge to harden some pieces of high-speed steel. Nearby was a new apprentice sweeping up the floor. Bill, thinking that he might as well kill two birds, called the youngster over to him.

"I want to show you something about hardening high-speed steel, Boy," volunteered Bill with a feeling of pride.

The young man stood nearby, leaning on his broom as Bill went through the educational paces.

"Now you see, young man, I bring the heat up slowly until the piece gets nice and red—about 1500 deg."

The boy said nothing and looked intently at the piece in the fire.

"Now after it gets good and hot I bring the heat up a little faster until the steel gets almost white heat—about 2300 deg.," he continued; then indicating the piece with the aid of his light tongs he cautioned, "You got to be careful here, Lad, or else you'll burn it up; watch carefully and you'll see it sweat."

The modern youth continued to look on and say nothing.

"Get ready now; I'm just about ready to put it in the fishoil—take it as quickly as possible and quench it deep at the same time moving it around to cool it as quickly as you can."

Bill stirred the piece in the oil and, when it had cooled sufficiently, withdrew it and held it up before the boy.

"See how clean and silvery it is?" he asked. "Now that's hard."

Bill continued to hold it up before the boy, expecting some enthusiastic reaction.

"So what?" ejaculated the product of modern times as he pushed his broom across the floor, to the profound disgust of Bill who lost no time in retreating to his bench, mumbling uncomplimentary remarks about jazz-fed lunatics!

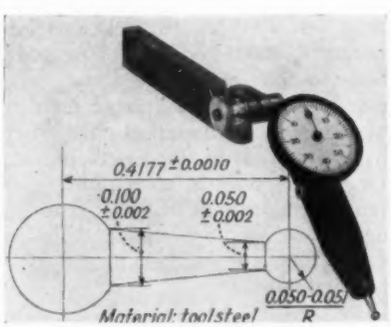
Jig Layout by Microscope

C. C. STREET
Chief Engineer, Federal Products Corporation

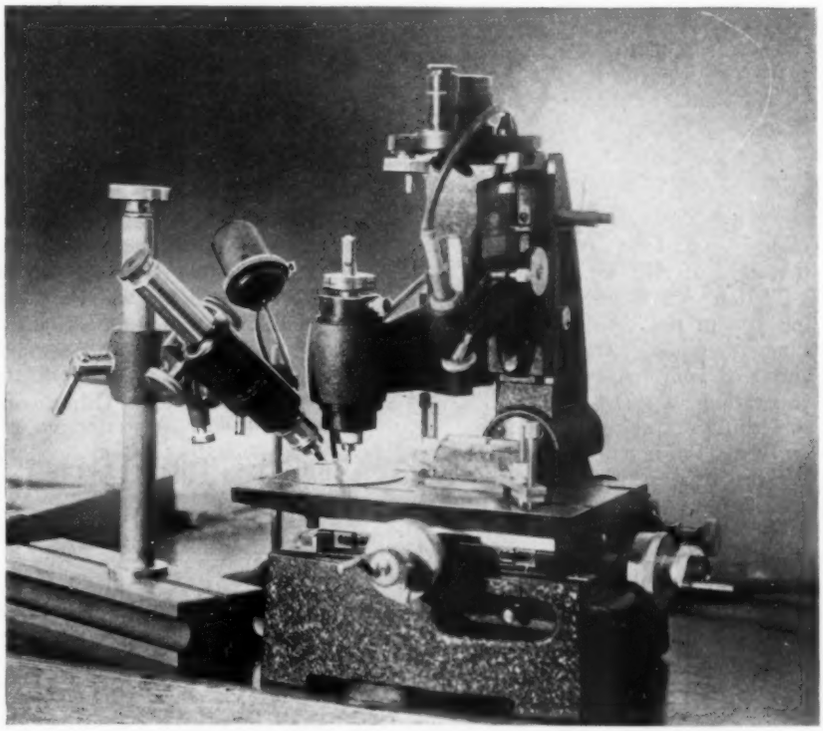
LOW COST and high accuracy are two factors that recommend the shop microscope as a tool for laying out small jigs. Experience with this method of jig layout at the Providence plant of Federal Products Corporation has been eminently satisfactory. Most of the jigs built by Federal are for locating holes in the plates of the corporation's dial indicators, parts that are essentially similar to watch plates.

One jig somewhat out of the ordinary was designed and built in the shop after commercial tool shops had had difficulty with it. The part to be jig-drilled is the contact point for the Model Two Indicator illustrated. A detail of the contact point blank after it comes from the screw machine is also shown. The spheres at the ends of the part must be drilled and the distance between the hole in the larger sphere and the center of the smaller sphere must be held to 0.001 in. This requirement involves a design of jig that will put no distorting force on the part during drilling.

To insure accuracy in this dimension the small end is placed on a support with a conical hole, and is held down by a flat plate on the latch of the jig. The large end rests between V's in both body and latch, the long axis of the V's being parallel to the axis of the contact point. In addition to a spring backing up the V's in the latch there is a screw to give positive pressure, the pressure being applied midway between the two spheres to equalize it on both of them. The V's permit endwise motion of the large end of the part to allow for minor differences in the blanks.



Federal Model Two Indicator and detail of contact point



Set-up for laying out jig plate under measuring microscope

The jig plate was heated until blue. It was laid out under the Zeiss measuring microscope with scribing attachment as shown in the halftone illustration.

The scribed plate was then attached to the face plate of an accurate bench lathe and the intersections of the scribed lines centered by means of a Bausch & Lomb monocular microscope barrel mounted on a special bracket that provides adjustment at right angles to the optical axis, and fits the toolpost of the cross slide. The cost of the microscope, a tube with coarse adjustment only, and with 32 mm. objective and 7.5X eyepiece with focusing cross hair, was $35.

Since the scribed line has appreciable width under the microscope, the cross hair is made tangent to one side of the line. When the piece is rotated 180 deg., the cross hair appears tangent to the side of the line as before, although this time it is the opposite side of the scratch that has been rotated into position. The same procedure is followed for the perpendicular location, the work being rotated 90 deg. so that the same cross hair is used as for the horizontal location.

When the intersection has been accurately located, which seldom takes over five minutes, a center drill or spotting tool (spotting tools are used for very small holes) is substituted for the microscope in the toolpost and the first hole put through. A larger hole is then drilled and rough bored, and the finish boring is done with a gun drill. It takes from 15 to 20 minutes to bore each hole ranging in size from 0.020 to 0.100 in. Larger holes take longer, of course.

Hardened drill bushings made in the shop are used in all Federal jigs.

ROUND TABLE

Wages Warranted

"What are you figuring on tonight?", asked Ed, as he stopped at the office of Al's small shop.

"I don't know whether I ought to tell you or not," stalled Al. "Every time I suggest something a jump ahead of your two-cylinder intellect you call me a starry-eyed idealist or something not quite flattering."

"Well, I'm not making any promises this time, Al; but I like to hear your funny notions whether I believe in them or not. What's the latest?"

"Ed, I've been thinking about this annual wage policy that some companies have started. It sounds like a pretty good thing to me."

"I knew it!" exclaimed Ed. "It's lucky you beat me to those fancy names I was going to call you or I'd have to think them up myself. That annual wage idea sounds sweet in theory but it's sour in practice."

"Anything new is sour to a reactionary like you, Ed, but getting down to cases, what's wrong with it? A man has to live all year, doesn't he? The rent comes due, the grocer has to be paid and the kids need shoes, twelve months a year. So why not an annual rate of pay?"

"I didn't say a man shouldn't have a full year's pay, Al. In fact he does now when he has a full year's work. What I do claim is that it's not up to any one employer to guarantee twelve months' work. He can't figure on his sales that close and naturally can't carry a big payroll when orders fall off."

"In spite of that, Ed, some companies are doing it right now. They're putting old men with a record of loyal service on a monthly payroll just like a foreman and giving them a vacation, too. It's considered a mark of honor to be put on the special list and the men work for it."

"Now you're talking about something different, Al. You can take a small group and reward them that way. That's simply a recognition of seniority or merit or whatever you want to call it. It doesn't affect the younger man or even the average man."

"That's not all, Ed. Other concerns go further and guarantee wages after a six months' trial period. They agree to give a man at least 48 weeks of work per year after he qualifies. Of course, the company has some leeway. It can work the full year or add men in busy times and cut down on normal replacement of employees who leave in dull times. But with that little leeway it seems to work."

"Yes, I've heard of such things. But always you find that company is making shoes or soap or some kind of consumer goods where the demand can be forecast with some accuracy. When you get to machinery and other industrial goods, the hills and valleys are too steep to estimate. Why a company could go broke fast if it tied itself up with a lot of guaranteed wages and the bottom dropped out of business. Especially with today's taxes."

"Part of the idea, Ed, is to get business men to think up ways and means to stabilize employment. If they knew they had men to pay they'd practically be forced to figure out some way to keep them busy."

"It would be nice, Al, but it's the wrong way to go at it. Business men are doing their best to get orders now without adding any more to their worries. Besides they're paying for unemployment insurance and that's assuming enough burden."

Is the guaranteed annual wage practical for makers of industrial goods? Would it tend to stabilize employment or make it worse by causing more bankruptcies in bad times?

DISCUSSION

Afternoon Pick-Up?

Al is setting no precedent by installing candy machines or by assisting financially in the athletic activities of his workmen. For years, hundreds of shops have followed similar practices with no adverse effect on output or efficiency. Some shops go so far as to supply free coffee in cold weather and lemonade in hot weather.

These small privileges will go a long way to keep the relations between Al and his men on a good basis. Few men will abuse such privileges. In fact, a large number of concerns will report that they have resulted in increased output. One large concern has a number of candy vending machines, also an up-to-date dining room. Profits from these are donated to the local hospital fund.

Personally, however, I question the need for a pick-up in the ma-

jority of shops. Judging by the past, fatiguing work is absent since much of the hard work in the average machine shop is now done by machine. Hours are shorter and environment incomparably better.

—ARTHUR SILVESTER

Loyalty—An Asset

Relationship between employees and employers has undergone changes which make it doubtful whether there ever can be the same sense of loyalty as was given to an employer with whom each workman was in almost daily contact. There is, however, at the present time, a genuine desire on the part of employers to create a better understanding with their employees.

Individual opinions as to whether loyalty should be encouraged will, in most cases, be influenced by one's own experiences. If the meaning is duty, there will be many who, while they cannot be accused of failing in this respect, would not make any claims of loyalty to their employers. The true test of each man's loyalty to his employer is when he receives an attractive offer to join another concern. It is often said that "every man has his price" and if this is true, the measure of every man's loyalty is the price offered for it.

Self-interest predominates in most of us and rightly so, for there is loyalty to those dependent on us as well as to employers. Most of us unfortunately, are familiar with cases where men have sacrificed their own interests out of loyalty to their employers and, after years of service, have found themselves discarded at an age when their prospects of further employment are almost negligible. In spite of this, it would be inadvisable to foster any other than a spirit of reciprocal loyalty between employers and employees.

—W. L. WATERHOUSE
Horfield, Bristol, England

To many workers, the foreman represents the company and the respect and loyalty he gains from his men is the respect the worker has for the company. If the foreman is inconsiderate, he cannot expect respect in return; no amount of money can heal a nasty rebuke.

Loyalty is instilled in the mind of the worker by the consideration the foreman gives his requests and the favors the foreman can gain for his men.

Often a man will deliberate for a long time before he leaves one job to accept another at higher wages if his present place of employment has treated him fairly. The experience of the past year has shown that the employer paying the highest wages is not immune to labor troubles. More than high wages is needed to keep a man happy and satisfied.

—ROBERT KNOTEK
Foreman, Die Department
Cleveland Division
Fisher Body Corporation

While most men are willing to make a financial sacrifice, they demand compensation from employer in the form of loyalty. The worker wants to be on equal terms with his boss, not to the point of calling him by his first name, but enough so that he can talk to him as man-to-man when necessary. He wants to feel important and necessary (as Al pointed out) to the functioning of the plant—not merely a cog in a great machine.

In this respect, the small company can "lord it over" larger firms, because its size makes close relationships possible. The larger the firm, the more probability there is of a worker knowing intimately only the superintendent instead of the president, the foreman instead of the superintendent, or the gang boss instead of the foreman. The small plant will find itself hopelessly outdistanced, however, if it tries to compete with large plants in the matter of wages; for the larger plant can, and will, pay a higher wage to get good men.

—EMIL J. RICHLIK

Weak Kneed?

A staff working without complete inter-departmental cooperation will not obtain the highest degree of success for the firm. However, years of experience has convinced me that there is a good deal of common sense in Ed's point of view as regards the word cooperation and the way it is often misconstrued. Cooperation often comes to mean inability, indecision and equivocations, thus emphasizing the old story "that a committee is a gathering place of important people who singly can do nothing but together may decide that nothing can be done." Such a state of affairs is easily brought about in shops where the leaders are restricted in following their duties and independent thought or action is forbidden.

Divided responsibility in any form is always dangerous. Heads of departments should be men well able to mind their own business and see that those who work for them have similar qualifications. Such men, in general, are usually good cooperators in the true sense of the word. They always are willing to give good advice to others on request, but soon raise a hullabaloo if others attempt to define cooperation as meddling, muddling and mischief-making, which appears to be the main cause of Ed's grievance. There seems some justification for Ed's fears that self-reliance may become a "lost art."

—F. P. TERRY
Belfast, Ireland

A good general plans a battle or campaign and the necessary maneuvers according to prevailing and anticipated opposition. He decides upon the best method of obtaining reinforcements and supplies at the time and place he wants to receive them, but does not trouble himself about the gasoline tanks of the trucks or airplanes being filled. He conceives the plan of action for major operations and instructs his staff to make it possible.

Cooperation is most valuable in a manufacturing plant where the manager can rely on cooperative effort on the part of experts in the different operations. Instead of the subordinates reporting to the manager regarding wrong conditions, it should be the other way around. The manager should give his general instructions and then call on his assistants to get the work done.

There is a real need for the practical dictator in manufacturing. There would then be no ponderous thinking and discussions with personal objections from the self-styled experts, no waiting for reports to come in, but with things kept moving according to a plan.

—W. A. HARRIS
Allesley, Coventry, England

Tell It All

One might ask Al how far he is willing to go in telling his men of the plans and policies of his company—would he also publish the minutes of the Board of Director's Meetings? Unless management will cut away from all prejudices and restrictions, making the men feel that they are considered as advisory partners in the business by printing details of its transactions, the situation would remain exactly what it is at present. This is not a case where a half-loaf is better than none.

—ALFRED M. WASBAUER
Malaunay, (Seine-Inf.), France

IDEAS FROM PRACTICAL MEN

Fixture for Turning and Facing Rings

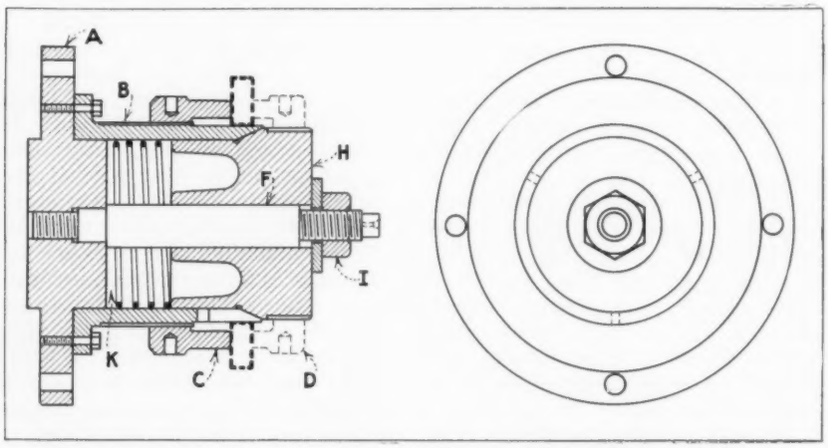
W. M. HALLIDAY
Peterborough, Northants, England

The fixture illustrated was designed for holding rings that had been previously bored for turning and facing both sides at one setting.

It consists of the plate *A;* the barrel *B;* the inner and outer check sleeves *C* and *D;* the stud *F;* the plug *H;* the clamping nut *I;* and the spring *K*. Plate *A* is piloted on the faceplate of the lathe to which it is attached by bolts. Barrel *B* is piloted on plate *A* and is attached to it and the faceplate by through bolts. Barrel *B* has two diameters, one being threaded for check sleeve *C,* while the other is left plain for a seat for the bore of the ring. The barrel is slit in three places and its outer end is underbeveled to suit the mating bevel on plug *H* so that it can be expanded by forcing the plug inward by tightening the clamping nut *I*. The outside of the plug is threaded for the sleeve *D,* shown in dotted lines. Both check sleeves are knurled on the outside for a hand grip and are drilled for a tommy pin.

In operation, the outer check sleeve is removed and the inner check sleeve is screwed to the left. A ring, shown in heavy dotted lines, is put on the right-hand end of the barrel and the inner check sleeve is screwed against it. The clamp nut is tightened, forcing the plug inward and expanding the outer end of the barrel in the bore of the ring and holding it securely. Thus set, the right-hand side of the ring is faced, after which the outer check sleeve is put on and is screwed tightly against the ring, holding it tightly between the two check sleeves. The periphery of the ring is then turned. The inner check sleeve is then backed away from the ring to permit the entrance of the facing tool and the left-hand side of the ring is faced, completing the job.

To remove the finished ring, the outer check sleeve is removed, the clamping nut is loosened and spring *K* forces the plug outward, permitting the slitted end of the barrel to collapse and let go its grip on the bore of the ring.



The ring is held on the barrel by expanding its slitted end by a plug, and is held sidewise by check sleeves threaded on both the barrel and the plug

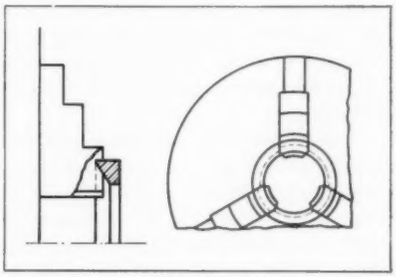
Truing Chuck Jaws

J. HOMEWOOD

Many successful schemes have been advanced for truing the jaws of three-jaw universal chucks. However another scheme added to the sum total will do no harm. In fact it might be of considerable benefit to the profession.

The idea that is suggested here is one that I hope will be considered of sufficient merit by chuck manufacturers to be worthy of universal adoption.

If chucks had notches in the faces of the male jaws, a steel ring faced at an angle could be used to hold the jaws in correct position to facilitate truing them by grinding. The sketch shows the scheme.



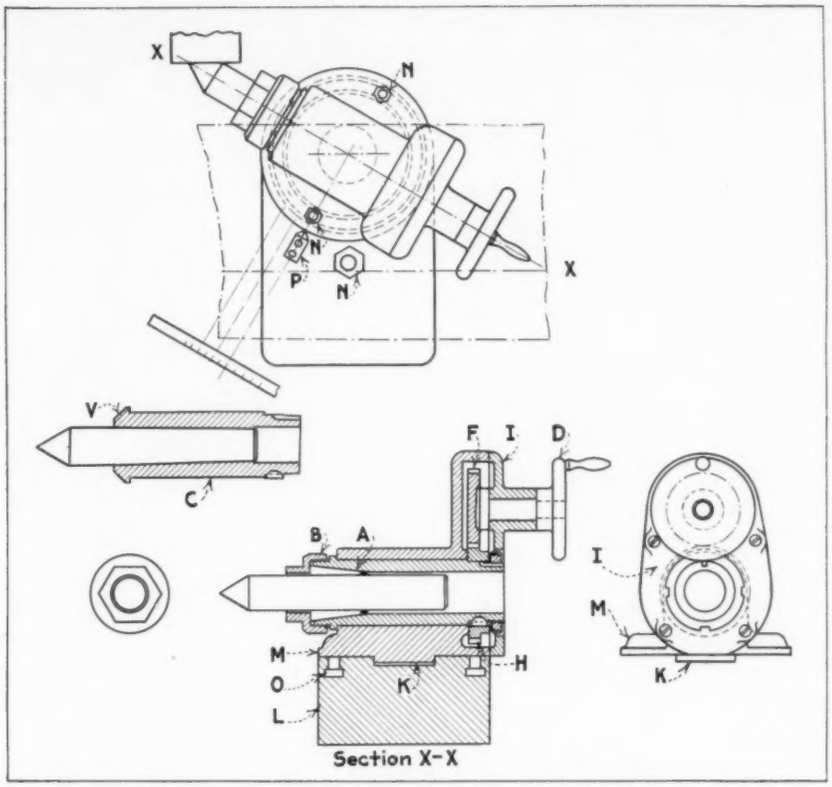
Notches in the jaws clamped on the edge of a ring faced at an angle hold the jaws in correct position for truing by grinding

Fixture for Grinding Pointed Work

J. R. WHITTLES

Pointed work, such as lathe centers and the like, can be ground by the plunge-cut method with the fixture shown. Work having a straight body is held in the spindle *A* by a spring collet which is closed by the nut *B*. By substituting a spindle having a taper hole, as at *C,* the fixture can be used for grinding lathe centers and other work having tapered bodies.

The spindle is revolved by the handwheel *D* through gears *F* and *H,* the hub of gear *F* having a bearing in the cast-iron cover *I,* while gear *H* is attached to the rear of the spindle by a Woodruff key. The boss *K* fits into a depression in the base *L* and forms a center about which the swiveling part *M* of the fixture can be rotated for grinding points having different angles. The swiveling part of the fixture is attached to the base by the two T-head bolts *N,* the heads of which travel in the circular T-slot *O*. The edge of the swiveling part is graduated in de-



Work having either straight or taper bodies can be ground to a point up to an included angle of 100 deg. in this fixture by the plunge-cut method

grees, pointer *P* being used to facilitate the reading. Work having points up to an included angle of 100 deg. can be ground.

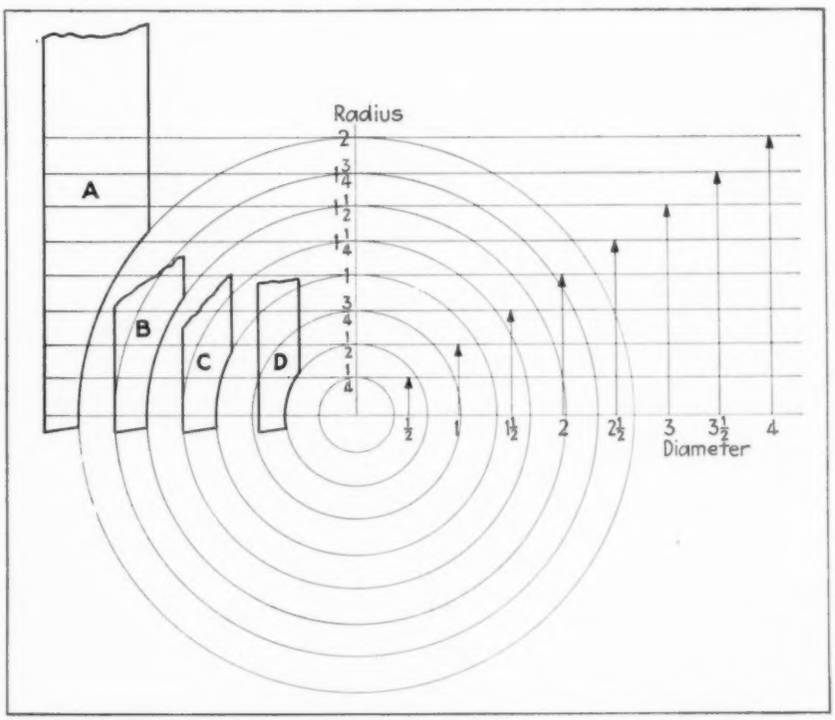
Chart for Cutting-Off and Rounding Tools

GAYLORD G. THOMPSON

In making studs it is generally the practice to round the exposed ends to a radius equal to their diameters. However, such a practice means that a large assortment of rounding tools would have to be carried to suit the diameters of all the studs made. It is difficult to visualize mentally just where to draw the line of limitation of each tool so that studs of two or more diameters could be rounded by the same tool, thus cutting down tooling expense. Therefore, the chart illustrated would give an instantaneous view of the range of tooling requirements. It shows how it could be used in establishing a group of tools that would cut off the studs and round the end of the stock. A feature of the chart is that the actual appearance of the finished curvature in proportion to the diameter of the stud can be seen at a glance.

It will be noticed that $\frac{1}{8}$-in. overlap is provided beyond the dead center of each tool so as not to leave a tit on the stock when the stud is cut off. The vertical line of figures refers to the radii of the circles and the horizontal row refers to their diameters.

If $\frac{1}{4}$ or $\frac{1}{2}$-in. studs are to be rounded to a radius of $\frac{1}{2}$-in., the tool *D* would fill the requirements. On the other hand, if tool *D* were used to round the end of a 1-in. stud to a radius of $\frac{1}{2}$ in., its formed cutting edge would have to extend farther around the circle of $\frac{1}{2}$-in. radius until it reached the vertical center line and the result would be that the end of the stud would be semicircular.



With this chart at hand, designers of combined cutting off and rounding tools can visualize how the proportion of rounding to radius will look

Improvised Rig for End Milling

A. B. HARVEST
Dunlop Tire & Rubber Company
Humber Bay, Ontario, Canada

The article under the above title by Charles Weslow (*AM*—Vol. 82, page 29) interested me.

If adoption of unique methods were the sole criterion, the set-up would certainly rank high in merit. While recognizing that the use of a vertical spindle has advantages and is indispensable for many milling operations, I fail to see that a vise held by the collars of an unsupported arbor and an end mill held in a drill chuck in the spindle of an electric bench drill mounted on the table afford a sufficiently rigid combination, even for light milling.

Mr. Weslow did not explain why he did not hold the work on an angle plate on the machine table. However, if the use of a vertical spindle should prove to be indispen-

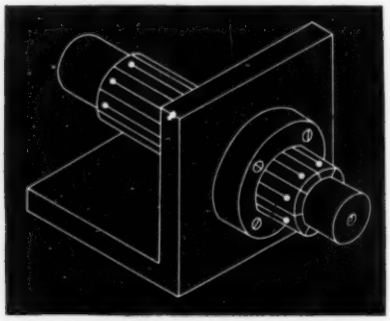
sable, I would attach it to the machine by the column, the overarm or the arbor support. For the makesift vertical spindle I would look either for the headstock of a small lathe or for a portable electric or pneumatic drill in first-class condition. For very small end mills, a toolpost grinder fitted with a suitable holder might also prove to be suitable.

New Use for an Expanding Mandrel

J. E. MOORE

Department of Industrial Education
Wichita High School East

Some time ago we had to attach a number of collars to the uprights of angle plates so that the holes in each



An expanding mandrel was used to align the hole in the collar with that in the angle plate while the screw holes were being drilled

would be in alignment. One of our students discovered that an expanding mandrel was a good tool to use for holding the collars in place while the screw holes were being drilled. The illustration shows the scheme.

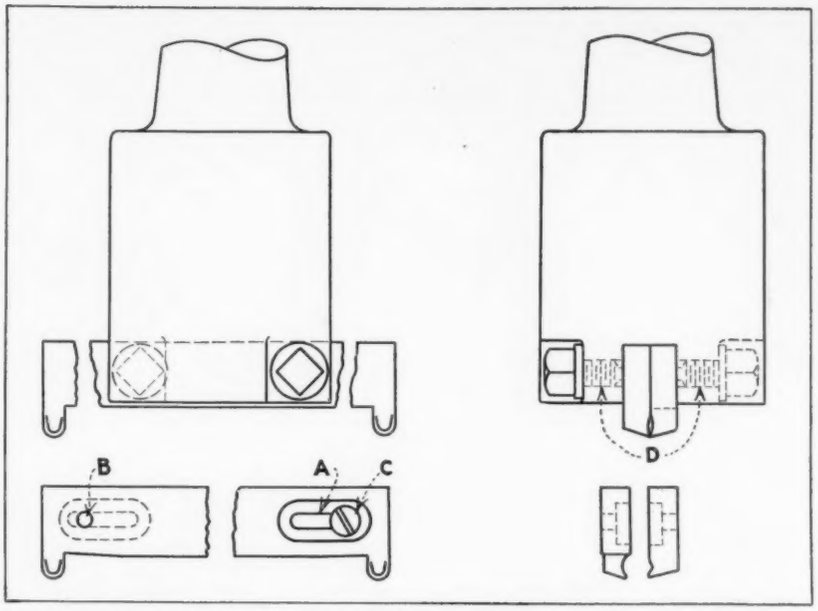
Sweep Tools in the Railroad Shop

R. G. HEWITT

Huddersfield, Yorkshire, England

I have read with interest the article under the above title by Frank C. Hudson (*AM*—Vol. 81, page 1219) and was impressed by the efficient tools described for machining the curved bearing-plate surfaces of the trailing truck frames. That is assuredly a quicker and better method than using a former plate for guiding the tool over the profile being machined.

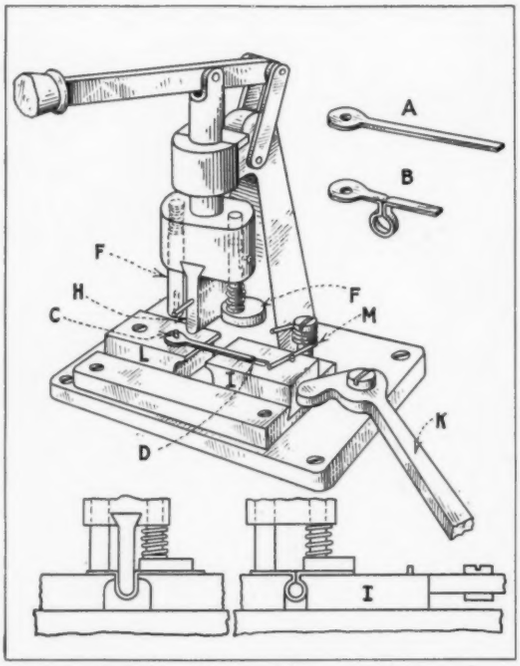
In the case of the tool shown in Fig. 3, used for cutting oil grooves, a saving in tool steel could be effected by using the alternative method here described. It consists of using two toolbits that are drilled and slotted at *A* and *B* to accommodate the retaining screws *C*. In the



Instead of a double ended toolbit for each diameter of oil groove, two adjustable toolbits are used, being set for diameter by the micrometer

illustration the toolbits are set for the 5¼-in. oil grooves. To expand the toolbits to cut the 6½-in. oil grooves, screws *C* are loosened and the toolbits are set out the required amount as measured by the micrometer. For securing the toolbits in the holder, locking screws *D* are tightened, the toolbits being set central before locking.

I have used this type of expanding tool on a variety of jobs and can vouch for its usefulness.



A U-shaped bend formed by a punch is made into a loop or eye around a pin and against an anvil by the formed end of a horizontal slide

Bending Loops in Small Parts

CHARLES H. WILLEY

Superintendent of Manufacturing
Hoyt Electrical Instrument Works

Hand-operated bench tools are necessary for small quantity production of many small parts for electric meters and other instruments. One such tool for forming loops or eyes in brass parts 1/32 in. thick is shown in the illustration, a blank and a finished part being shown at *A* and *B* respectively.

In operation, a blank is placed on the pin *C* and is aligned by its opposite end engaging the slot D. When the ram is brought down by the lever at the top, the pressure pads *F* hold the part in position while the punch *H* forms a U-shaped bend in the center. The ram is then raised and the punch *H* is pulled out of its dovetailed slot in the punch-holder by hand. The ram is again lowered and the pressure pads hold the part as before. A piece of drill rod of the proper size is inserted in the U-bend and the slide *I* is brought up to the part by the lever *K*, bending the U-shaped or eye around the pin and against the anvil *L*. Spring *M* returns the slide to its position.

AMERICAN MACHINIST *Reference Book Sheet*

Chip Thickness in Milling

C. H. BORNEMAN
Supervisor, Tool & Gage Service Department
Schenectady Works, General Electric Company

IN DATA ON milling operations "feed per tooth" is sometimes called "chip load per tooth". "Chip load per tooth" in the sense of thickness of the thickest part of the chip might probably better be called "effective chip thickness". The actual chip produced will, of course, be much thicker than the effective chip thickness. This is due to the crowding action of the milling cutter tooth. Feed per tooth and effective chip thickness are identical only when the depth of cut extends to the path in which the axis of the cutter travels relative to the work during the cut.

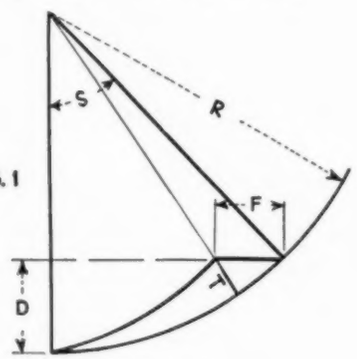
The amount that feed per tooth exceeds effective chip thickness is controlled by the relation of depth of cut to cutter diameter. A study of the accompanying chart (next page) will reveal that for a depth of cut which is shallow as compared with the cutter diameter,the feed per tooth may be several times the effective chip thickness. This chart has been devised to facilitate analysis of milling operations from the chip thickness standpoint.

Referring to the chart, the intersection of the horizontal line representing a given depth of cut with the vertical line representing the cutter diameter will determine a factor (represented by a diagonal line). This factor multiplied by the desired effective chip thickness gives the required feed per tooth. Conversely, a given feed per tooth divided by this factor will give the effective chip thickness.

Care should be exercised in determining effective chip thickness for staggered or alternate tooth milling cutters, as the chip thickness in some instances is here determined by the feed per two teeth. In such cases the number of teeth of the cutter should be divided by two for calculation purposes.

Referring to the diagram, Fig. 1,

FIG. 1



R is the radius of cutter
F is the feed per tooth
T is the effective chip thickness
D is the depth of cut

The values for plotting this chart were arrived at as follows:

$$R^2 = (R \sin S)^2 + (R \cos S)^2$$

$$(R - T)^2 = (R \sin S - F)^2 + (R \cos S)^2$$

$$R^2 - (R - T)^2 = (R \sin S)^2 - (R \sin S - F)^2$$

$$R^2 - R^2 + 2RT - T^2 = (R \sin S)^2 - (R \sin S)^2 + 2FR \sin S - F^2$$

$$\frac{2RT - T^2 + F^2}{2FR} = \sin S$$

For plotting purposes arbitrary values of R and T are taken; also F assumes values in multiples of T according to the number of factor lines to be plotted. These values are tabulated in the accompanying table. Sin S having been found, arc sin S is determined from a table of trigonometric functions. The values $D = R(1 - \cos S)$ are then also entered in the table. Enough values D to establish each factor line are then plotted on the chart, as shown on the following page.

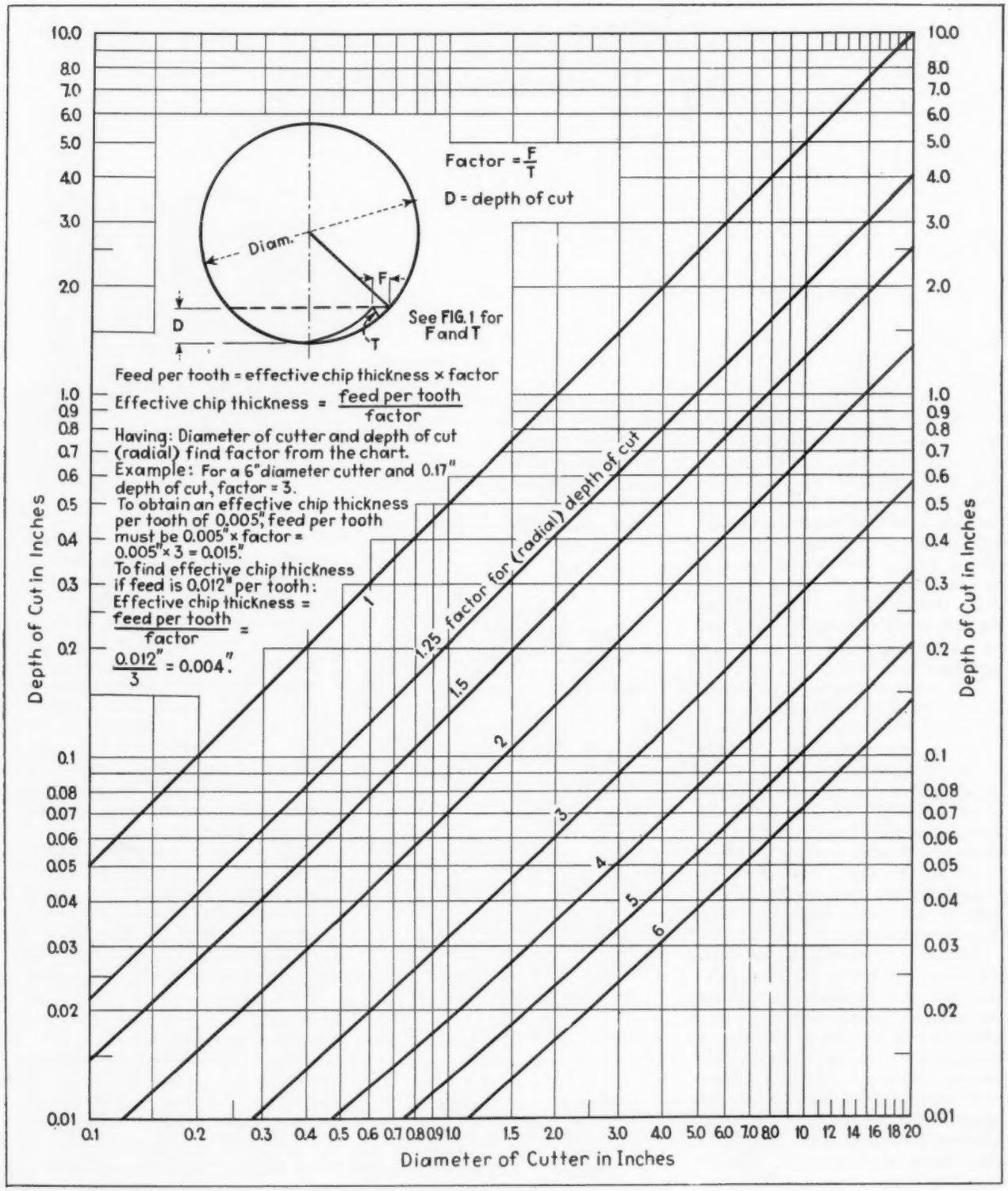
To approach in practice a uniform effective chip thickness, milling cutters must run as nearly true as practical. Eccentricity and uneven height of teeth overload the high teeth; the resultant finish is also rough. This is especially noticeable when coarse feeds are used.

Calculated Data for Plotting Chart

T	F	R	$\sin S$	arc $\sin S$	D
0.005	1.5T=0.0075	0.5	0.6708	42°-8′	0.1292
0.005	1.5T=0.0075	1.	0.6687	41°-58′	0.2565
0.005	1.5T=0.0075	2.	0.6677	41°-54′	0.5113
0.005	1.5T=0.0075	6.	0.6669	41°-50′	1.529
0.005	1.5T=0.0075	10.	0.66687	41°-49′	2.547

AMERICAN MACHINIST *Reference Book Sheet*

Chip Thickness in Milling


Factor = F/T
D = depth of cut
Diam.
F
D
T
See FIG. 1 for F and T
Feed per tooth = effective chip thickness × factor
Effective chip thickness = feed per tooth / factor
Having: Diameter of cutter and depth of cut (radial) find factor from the chart.
Example: For a 6" diameter cutter and 0.17" depth of cut, factor = 3.
To obtain an effective chip thickness per tooth of 0.005", feed per tooth must be 0.005" × factor = 0.005" × 3 = 0.015".
To find effective chip thickness if feed is 0.012" per tooth:
Effective chip thickness = feed per tooth / factor = 0.012" / 3 = 0.004".
Factor for (radial) depth of cut
1
1.25
1.5
2
3
4
5
6
Depth of Cut in Inches
Diameter of Cutter in Inches
10.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.08 0.07 0.06 0.05 0.04 0.03 0.02 0.01
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.5 2.0 3.0 4.0 5.0 6.0 7.0 8.0 10 12 14 16 18 20

NEWS OF THE INDUSTRY

Millions to Be Spent Preparing Ship Yards to Build Battleships

Navy alone will make outlay of $8,000,000 to provide new facilities and equipment for expansion program

BURNHAM FINNEY
Editor, American Machinist

WASHINGTON — The government's naval expansion program, now close to passage by Congress, will require expenditures of millions by shipbuilding companies and by Navy yards for enlargement of facilities and modernization of equipment. The Navy alone is to be allotted eight million dollars to make it possible to construct any ship authorized in the bill, including battleships, at the New York, Philadelphia, Norfolk and Puget Sound navy yards. There are now no yards, either naval or private, on the Pacific equipped to build battleships, and facilities are lacking for speedy construction of vessels of lesser tonnage. Some of the work, according to the new bill, is to be done in the Far West. The program provides for 46 combatant ships.

No battleships have been constructed by private companies since 1923 and until the New York and Philadelphia Navy yards each undertook recently to build a battleship authorized by Congress in 1937, the government itself had not tackled such a task since war days. That means that the country's facilities for carrying out a battleship-building plan of any magnitude are obsolete and inadequate. The first thing to be done, as soon as Congress passes the requested legislation, is to put these facilities into proper shape for the gigantic job ahead.

It is no exaggeration to call the job "gigantic." Take a look for a moment at the factors involved. A 35,000-ton battleship takes 4,900,000 man-days (based on an eight-hour day) of work in the shipbuilding yard. With the work to be done outside included, the time adds up to 9,500,000 man-days. Materials and parts for the battleship come from almost all of the 48 states. The total cost is $70,000,000.

But that isn't all. Normally 76 months elapses from the time a battleship is authorized until it joins the fleet. Thus it would be 1944 before a battleship started in 1938 is ready for active duty. Twelve months is consumed in developing the design, four months in preparing contract plans, three months in preparing price estimates, 51 months in building and six months in testing the ship and "breaking in" the crew. In times of emergency this period can be shortened to 46 months by duplicating the design of an existing battleship and by cutting construction time to 42 months by means of overtime work.

WHAT THE NAVY BOUGHT

Machine tool purchases by the Navy for the last eight years have been as follows:

1930	$1,500,000
1931	1,500,000
1932	900,000
1933	200,000
1934	1,451,220
1935	925,000
1936	1,600,000
1937	1,500,000

On a basis of 20 years as the maximum life of navy yard tools, $1,900,000 would be needed each year for replacements. But a huge initial outlay would be necessary to bring equipment within the 20-year age limit.

Even in the case of much smaller craft than battleships, the building task is big. A 1600-ton destroyer, for example, requires 30 months to build, involves a total of 1,100,000 man-days and costs $8,000,000.

Navy work, according to the Vinson Act, is to be about evenly divided between Navy yards and private shipbuilding companies. The two battleships already authorized are being constructed by the government. It is hoped that private bids for the two authorized in the 1939 program will be sufficiently in line that they can be awarded outside. If two more are authorized, as appears probable, the Navy wants to allot one of them to private companies. Thus private yards stand an excellent chance of securing three of the four battleships likely to be started in the next year. Only three companies—Bethlehem Shipbuilding, New York Shipbuilding and Newport News—have the experience, facilities and resources to undertake building battleships.

The two cruisers recently authorized for the Navy are being privately built because Navy estimates indicated that the cost at the Navy yards would be much more than the bids submitted by private companies. It is likely, that the two additional cruisers provided for in the pending bill will be awarded to Navy yards to even matters under the Vinson Act.

While shipbuilding companies are burdened with extra expenses, such as insurance and taxes, which do not have to be considered by the Navy in figuring manufacturing costs, the Navy thinks that its labor cost is higher than that of private companies. Though mechanical workers in the Navy yards are on a 40-hour week of five 8-hour days, they are given each year 26 days' vacation (leave of absence) and 15-days' sick-leave with full pay. The extra pay plus higher wage rates runs up the labor cost so that the government today pays out close to $1.50 for every $1 it used to spend.

Incidentally, the government does no collective bargaining with its employees, but shipyard workers are

mostly organized, some belonging to the A. F. of L. and others to the C.I.O. If a vote were taken today, it is believed by the well-informed that the former would win easily.

The Navy expansion bill probably will be amended to provide a 6% cost differential on West Coast ship construction. This allowance, which is the same as that in the merchant marine act, would take care of higher freight charges on materials and other disadvantages due to distance from industrial centers. People close to the Navy Department contend, however, that ships can be built at the same price on the Pacific as on the Atlantic (perhaps so, retort private companies, if we kept our books the same way the Navy does). The only reason, they say, why a private company should submit a higher bid at a Pacific point is that it would have to "start from scratch" and make a huge investment in a Pacific plant which it does not now possess.

When the naval program starts, there will be a wild scramble for skilled workers. It is admitted that draftsmen too will be hard to get. If necessary, the Navy plans to reopen training schools for certain classes of employees.

Almost the only impetus to industry in 1938 from the naval-building program will come from orders for machinery and materials for enlarging shipbuilding facilities and perhaps from a few orders for big units, such as engines and winches. Steel for the ships won't be needed until well into 1939, if that soon. For almost a year after the program is approved, the Navy and shipbuilding companies will be "up to their necks" in the engineering design phases before the point is reached where construction can begin.

Though not satisfied with the physical condition of machine tools in Navy yards, Naval officials feel that it is constantly improving because of the policy of spending around $1,500,000 annually for new equipment.

Gray Iron Founders to Meet in Buffalo

Speakers of national reputation will be on the morning program of the annual meeting of the Gray Iron Founders' Society in Buffalo on March 25. The session will be held at the Hotel Statler. In the afternoon a discussion of matters of interest to the gray iron industry executives will be followed by the annual meeting and election of officers.

This poster, issued by the Department of Commerce and Industry, Tokyo, speaks of Japan's desire to become a great automotive nation. Japan's motor-car industry has made rapid strides in the past two years, and has become an increasingly important customer for American equipment

Japanese Navy Sponsors Huge Machine Tool Plant

National-policy concern to be set up with German-Italian aid

TOKYO—Rear-admiral Kiyoshi Hara of the Cabinet's planning board and chief of the first section of the Navy's construction department, has worked out a plan with naval officers for a revision of the current five-year machine tool production policy.

Approval of the ministries of War, Commerce and Industry has already been obtained.

It is stated that the previous plan to combine the five biggest machine-tool concerns of the country failed to materialize for various reasons. It is therefore suggested to establish an entirely new national-policy concern to be capitalized at 50,000,000 yen from the start. Not only private capital at home, but also foreign investment in form of machinery and materials will be invited, the rear-admiral's report states.

The firm's manufacturing capacity is to be 8,000,000 yen in the first year, 15,000,000 yen in the second and 50,000,000 yen in the fifth year.

Engineers will be invited from Germany and Italy, the co-signatories to the anti-Comintern pact. It is hoped that complete self-sufficiency in machine tools will be attained in the sixth year. None of the five big machinery concerns will be allowed to participate, nor will the capital of the machine-tool importers be admitted.

During the first and second years after the organization of the firm ordinary lathes and similar simple machines will be built. Precision work will be taken up at a later date, according to the report. The company will receive a guaranteed minimum of orders by the Army and Navy, although private firms so far have been denied this.

It is further reported that the Minister of Commerce and Industry will invite for a conference representatives of the ministries of War and Navy as well as of the planning board of the Cabinet in order to discuss the question of increase in machine-tool production without incurring new national expenditures.

The installation of new equipment is becoming increasingly difficult due to the prevailing import restrictions. For this reason the authorities concerned are now centering their efforts on a rationalization rather than expansion of the existing facilities. It is claimed that the five big machine-tool makers and many smaller plants are not operating their equipment to the extent required under the present circumstances, and that, therefore, "control" is needed.

Small Shops to Organize

The medium and small-scale makers will be urged to organize associations and subsidize shops managed by the associations which are to specialize in the kinds of machine tools they are most fitted to turn out with their present equipment. The government plan further envisages a close cooperation among small firms and the "big five" on a subcontracting basis.

The Japanese Railway Ministry has joined a group of leading industrial plants in preparing for self-supply of machine tools in its own construction shops. The move has been stimulated by the shortage of tools in the local market. A number of radial drill samples have already been completed, and it is hoped that ultimately all equipment for locomotive construction will be supplied by the railway shops.

Reflecting Japan's political relations with foreign countries, recent machinery inquiries mostly concern American, German and Italian makes, while imports from England have practically come to a standstill. This development attracts attention because British firms are now among the promptest in point of delivering, while particularly German makers are unable to accept short-term orders.

DETROIT LETTER

Automotive trade is feeling better . . . Companies debate what to do about prices . . . Junking plan may be revived to aid used car problem . . . Tool and die shops "contract" for future business . . . Machinery orders gain . . . 1939 programs delayed

DETROIT—Detroit the past few weeks has gone through one of its periodic revivals of optimism. With used car sales picking up even prior to the Used Car Exchange Week circus, and new cars beginning to move at steadily increasing speed, the psychological pendulum has swung past the low point.

Reports of impending big steel releases are rampant. Machinery buying may reach a new peak within a couple of months, according to the optimists. Some are looking for production as high as 150,000 cars a week during the early summer. But that is characteristic of Detroit. The Motor City never does things halfway. When business is bad or slowing up, the town is the bluest in the country. When there is a break in the clouds, nothing but sunshine can be seen.

Business IS better in Detroit, and it will be still better during the coming months, but so far there has been no indication that the improvement is anything but seasonal. True enough, used cars have been moving faster than they did a year ago, but in early 1937 there weren't as many used cars in dealers' hands nor was there as much price-cutting on used cars as there has been of late.

Talk of the town for weeks has been the used car program sponsored by the factories. While the program already has reduced dealer inventories of used cars of recent vintages, it is not affecting much the total number of cars in stock. In other words, frozen dealer capital is being partially released for doing new car business, but the remainder is frozen a bit tighter in older models of used cars taken in exchange.

Just what the industry is going to do about this is a problem. The feeling is that some form of junking plan will have to be revived. It will be remembered that during the big depression factories tacked $20 to $30 on each new car and set this aside in a junking fund. The money was allocated to dealers in proportion to new cars sold and paid to them when the oldest used cars were junked by the dealer under factory supervision.

Reestablishment of such a plan would tend to offset any leaning toward lower delivered prices on new cars. Right now it is a question whether prices will go down. Most manufacturers want to keep prices where they are, believing that a reduction would not increase sales or production sufficiently to offset the loss in revenues.

By March 12, however, the unwritten agreement not to cut prices during the used car clearance campaign will be unofficially terminated. Most companies will then be on their own, and it would be surprising if at least one or two manufacturers did not cut some models in an attempt to increase their percentage of business. Such action would precipitate a general movement. Only the agreement to maintain new car prices kept some manufacturers from following Packard's lead when that company cut prices on its six.

It wouldn't take much of a shove to move the car factories toward either higher or lower prices. For one thing, factories have had little success in getting parts prices reduced. The trouble is that parts producers are on the spot themselves. To them lower prices inevitably would mean lower wages, and the entire industry is pretty well set on resisting this as far as possible. As a matter of fact, a check among individual parts companies shows a surprising stability in wage rates, which remain well above the 1929 level.

Steel inventories at most plants, have about reached the desired minimum, and already there has been a pick-up in steel orders beyond the increase in production. It must be remembered, of course, that steel orders normally anticipate motor car assemblies by about 60 days. But that is for normal times and the general rule may not hold this year.

Machinery releases are a bit larger. Ford's tractor program is slowly progressing and some orders have been placed. General Motors divisions are more active. Chevrolet has released several orders for new machinery, largely for increasing efficiency in its parts manufacturing plants. Chrysler has ordered some

For Winter Driving Comfort—Chevrolet presses an asphalt-impregnated insulating material into permanent contact with steel floor boards. The floor boards are shown emerging from a huge electric refrigerator that cools them so that they can be trimmed on the machine at the right

new machines, most of them apparently being in connection with new model work, since August 1 delivery dates were specified. So far, however, the anticipated huge demand for machine tools has not materialized.

A major trouble is that tool and die programs for 1939 models have not crystallized in individual plants. The reason is simple. Whenever the industry makes major changes, everyone delays final plans until he finds out what the other fellow is going to do. Ordinarily, that doesn't involve long delays. Someone usually makes up his mind on next year's cars and releases orders for tools and dies. Others then fall in line and try to do just about the same thing, or something a bit different.

This year, with nobody ready with final plans on 1939 cars, there has been little to go by. Even Buick, usually among the first out with new models, doesn't know what it wants. After releasing some heavy die work, it is reported to have recalled the orders. The past two weeks there has been a little gain in die work. The most important development has been the attempt of several companies to sign up tool and die shops in advance of release for definite percentages of their capacity—when, as and if needed. Some of the larger shops have gone along with this program and have contracted for as much as three-quarters of their capacity in return for a promise of the business when it comes.

This move is unusual, considering the normal tendency of the industry to buy on a purely competitive basis, but car factories have had their hands burned before in not being able to get tool and die work done when they needed it, and seem to prefer not to take a chance on being delayed on new model work too late into the fall.

From a labor angle, the attitude of Detroit's new city administration is causing the unions no little concern. Before his election Mayor Reading issued an edict against sit-down strikes, and last week showed he was as good as his word in having strikers ejected from a small parts plant in Detroit.

The action, attacked by Homer Martin, was a relief to many small shops which have been worried about what would happen when production picks up and the U.A.W. tries to collect dues again. The generally favored Union method is to throw a picket line around a plant and prevent workers from entering until they have shown a receipt for dues.

Blank & Stoller

GEORGE H. BUCHER

George Bucher Elected Westinghouse President

NEW YORK—George H. Bucher, executive vice-president of the Westinghouse Electric & Manufacturing Co., has been elected president of the company. Frank A. Merrick, president since 1929, was elected vice chairman. The announcement was made by A. W. Robertson, chairman, following a meeting of the board of directors at the company's New York offices.

Paul Judson Myler, president of the Canadian Westinghouse Co., became a director of the Westinghouse Electric & Manufacturing Co., at the same meeting.

Mr. Bucher and Mr. Merrick have both been with the Westinghouse Company for many years. As a member of the graduate students' training course, Mr. Bucher began his work with the company on Sept. 1, 1909, in an assembly aisle at the East Pittsburgh plant at a wage of 18 cents an hour.

Hot Dip Galvanizers Elect T. M. Gregory

PITTSBURGH—At the annual meeting of the Hot Dip Galvanizers Association on Feb. 24 the following were elected: president—T. M. Gregory of the Hanlon-Gregory Galvanizing Co.; first vice-president—I. M. Hermann of the Acme Galvanizing Co.; second vice-president—D. R. Pearlman of the Enterprise Galvanizing Co.; secretary-treasurer—Stuart J. Swensson. The above officers were re-elected.

Directors are F. P. Auxer of the National Telephone Supply Co.; A. J. Blaeser of the Joslyn Manufacturing & Supply Co.; and W. J. Gregory of the Thomas Gregory Galvanizing Works. Wallace G. Imhoff was retained as technical director of research. It was decided to formulate standard specifications for several product specifications in addition to those now in force.

A.S.T.E. Charters Philadelphia Chapter

PHILADELPHIA—Chapter No. 15 of the American Society of Tool Engineers was chartered at a dinner meeting held at the Hotel Adelphia on Thursday evening, Feb. 24. Ford R. Lamb, executive secretary of the Society, and Charles F. Staples, chairman of the Detroit Chapter, officiated at the meeting. Approximately 125 men attended and 40 applications for membership were submitted.

The organizing committee responsible for development of the Philadelphia Chapter was composed of Fred Wood, general foreman, J. G. Brill Co.; A. W. Lovell, master mechanic, SKF Industries; Edward R. Glenn, sales representative, Wesson Co.; William L. Battersby, sales representative, Illinois Tool Works; Conrad O. Hersam, consulting engineer; Joseph MacNamee, works manager, H. Brinton Co.; Paul W. Frankfurter, sales representative, Pangborn Corp.; and Ben Peter, chief tool engineer, Heintz Mfg. Co.

Officers elected were: chairman—Conrad O. Hersam; vice-chairman—William L. Battersby; secretary—Edward R. Glenn, and treasurer—Paul Frankfurter.

Ford R. Lamb, executive secretary of the A.S.T.E., discusses plans for the new chapter with Conrad O. Hersam, newly elected chairman

WATCHING WASHINGTON

British not expected to seek trade concessions affecting metal-working industry . . . Machinery and metals are not believed to be within scope of Reciprocal Trade Law . . . Maritime Commission and shipbuilders still in bitter deadlock

McGRAW-HILL WASHINGTON BUREAU
(Paul Wooton, Chief)

WASHINGTON—Some 75 items of machine tools, machines, parts, wire and wire rope, steel ingots, steel shapes, castings, forgings and ores are listed for consideration in negotiations toward the forthcoming reciprocal trade agreements with the United Kingdom and Canada. Hearings on the British agreement open March 14, and on the Canadian agreement April 4.

Listing of items for discussion, however, does not mean that import rates on them will be changed. Nothing at all may happen. In fact, most of the machine and metal items seem to have been listed as an afterthought by the British, to make sure they didn't miss anything. One high official with their delegation in Washington could not explain the presence of the items on the schedule. He said they were not on the original list, but were added later.

Nevertheless the steel and metal-working industry in general is filing briefs with the Tariff Commission's Reciprocity Committee on Information, protesting rate reductions. Most of the firms feel that verbal testimony in addition is a waste of time, and not many of them will appear. Some believe it is better to keep away from the Commission and not attract the attention of the free traders who are always "kabitzing" along the tariff sidelines.

But the discussions will bear close watching, and the industry's representatives here are not missing any tricks. They will be particularly alert for some item which, if the rates were slightly reduced, might rise from a mere trickle to a flood. That very thing has happened in other lines. But so far, nothing with such possibilities has been spotted.

The unanswerable argument against tariff concessions to Britain on machinery and metals is that Britain is in only minor instances the chief supplier to this country. Therefore, in these lines, she does not come within the scope of the reciprocal trade law. Nor is it probable that England will ask for concessions affecting the metal-working industry. The State Department's barrier-lowering policy—the generalization of world trade bases—is too broad to admit of dealing in such small change.

And machinery imports from Britain are small change indeed. Of a total of $15,000,000 of industrial machinery imports (except agricultural and electrical) in 1936, less than $3,000,000 came from Britain. Of $2,000,000 of textile machinery imported in that year, $629,000 came from Britain. The United States bought only $835,000 of anti-friction bearings abroad, and $209,000 came from Britain. The import of machine tools from all countries was just $635,000 and the British portion was negligible.

Some members of the industry fear that the advantages England will gain from the trade agreement with the United States will impel Germany to seek reinstatement as a "favored nation" under the Hull program. Germany and Australia were declared ineligible to sell to this country at favored nation rates, because they discriminated against the United States by means of barter exchange and private compensation book-keeping transactions. Australia has since been reinstated, leaving Germany as the only black sheep. But trade experts in Washington say that it would cost Germany more to revise her system to jibe with our program that it would be worth to her. Of course, Germany could do a land-office business in competition with the industry here, but they don't think she will make the change. They believe, on the other hand, that what Germany does with us now will be reduced under stimulated business with England.

Sixteen Agreements

Under authority of the reciprocal trade amendment to the Tariff Act of 1930, the State Department has made 16 "most favored nation" agreements: seven with European countries, eight in South America, and one with Canada. The Canadian agreement soon expires, and present negotiations are for its renewal. These 16 agreements cover about 40 per cent of our foreign trade. The Anglo-American agreement, which will be concluded some time in late Spring or early Summer, will be the king-pin of the New Deal's foreign trade policy. The result will mean the eventual success or failure of this policy.

The reciprocal trade plan is really quite simple, though few take the trouble to understand it. The State Department starts conversations with a country on items of which that country is chief supplier to this country. The two swap tariff reductions, looking toward a greater volume of trade and a greater variety of goods (the idea is that trade stagnation and privation cause war, that no nation can be prosperous amid international poverty). Then, having gained its

NEW PLANT DEDUCTIBLE?

It now seems fairly certain that corporation expenditures for new machinery and new plant, even when obviously far in excess of normal depreciation—in fact with no limit whatever—may be deducted before computing the tax on undistributed earnings. Actually, a majority of the Senate Finance Committee, which will rewrite the House tax bill, would like to repeal the tax on undistributed earnings altogether, but this is still unlikely. Some face saving remnant of the principle of the tax, so strongly advocated by Roosevelt, seems politically necessary.

The President is just as strongly against exempting new plant, and any degree of new machinery and other equipment beyond replacement, as ever. This contention of his is of the warp and woof of his economic doctrine. But the President knows he must compromise to an extent to which he has never been driven before, in his Albany and Washington experience. He has practically admitted this to Congressional leaders so far as the tax bill is concerned. All he really hopes for is a little face saving.

advantage in a deal with the biggest trader, the United States grants the same import rates to all other countries that sell us the same lines, whether they have made agreements with us or not. If, after an agreement with a chief supplier nation, some other nation becomes chief supplier of items on which the deal was made, the first nation can abrogate the agreement.

There is one fairly nifty trick in the deck. The parties to the agreement can so carefully and rigidly describe an article that only the nation that makes the article described *can* make it. In that sense the program is not very reciprocal. But otherwise it is plenty, say manufacturers adversely affected.

Shipping Controversy

Because big shipbuilding companies' bids were considered too high, four of the Maritime Commission's proposed fleet of 12 cargo boats have been awarded to the Tampa Shipbuilding & Engineering Co., Tampa, bid $1,815,663 on each of the four ships of standard C-2 design with diesel engine, single-screw propeller and steel hull.

In reply to criticisms that the Tampa company isn't capable of handling such a big job, the Maritime Commission states that "careful investigation has satisfied the Commission that this shipyard is equipped to do the work." While the Commission does not say so, it may ask for RFC loans to finance additional equipment and facilities for the Tampa company. In effect, the Commission's answer to the high bidders is a threat to assist in the rehabilitation of small companies while the big firms are engaged in big-navy building.

Though shipbuilders deny the fact, Washington hears that the big companies didn't want the Commission's business on account of elaborate legal restrictions. Here are the restrictions: No contract shall be made for the construction of any vessel unless the shipbuilder shall agree (1) to make an elaborate sworn report; (2) to return to the commission any profit over 10%, profit to be determined by the Commission; (3) to make no subdivision of contract to evade provisions of the act; (4) to permit all the company's books to be inspected; (5) to permit all subcontracts to be inspected; (6) to agree that no salary over $25,000 will be computed in the costs; and (7) to allow Treasury employees to determine and collect the profits. While shipbuilders' earnings are restricted, there is no protection against losses.

What ruffled the big shipbuilders was that former chairman Jospeh P. Kennedy and President Roosevelt "sounded off" against their alleged high prices without giving them a chance to explain them. Shipbuilders point out that costs are largely beyond their control, only 40% being for work performed within a shipyard. Uncontrollable factors are the requirements of design and of specifications, prevailing labor rates and prevailing material costs.

Construction of cargo boats abroad is unthinkable. On the other hand, the Commission and shipbuilders may find common ground for compromise on the eight boats yet to be awarded. It is possible that modifications of the present expensive boat designs may enable big shipbuilders to submit prices considerably below the original bids. Hearings to determine why merchant ships cost so much, as indicated by recent bids, are under way in the House merchant marine committee. Evidence on ship costs is so full of complications and abstractions that the report probably won't mean much.

South America Is Heavy Buyer of Machine Tools

German Competition Is Becoming Increasingly Strong

NEW YORK—Rehabilitation and expansion programs for government works of South American countries are causing a lively export trade in new machine tools. Industrial concerns are also active. Specialties peculiarly adaptable to certain uses are in greatest demand, whereas standard quality machine tools were somewhat less active in February than in January.

Foreign competition is becoming stronger because delivery dates now are more nearly in line with those specified by American manufacturers. From six to seven months is the average required here, and strenuous efforts are being made abroad to beat this time. This is true of Germany, which needs foreign exchange badly, and which, it is believed, will often divert some items from its own rearmament program in order to make the deal.

Exports of Machinery During January, 1938

	January 1938	December 1937	January 1937
Electrical machinery and apparatus	$7,787,058	$9,797,476	$7,471,528
Power generating machinery except automotive and electric	3,529,424	1,565,450	1,200,987
Construction and conveying machinery	1,934,184	2,066,984	1,201,130
Mining, well and pumping machinery	4,597,388	5,203,635	4,565,500
Power driven, metal-working machinery	5,968,604	7,720,824	4,314,629
Other metal-working machinery	297,761	359,361	270,877
Textile machinery	1,004,746	1,135,687	673,937

Exports of Metal-Working Machinery During January, 1938

	January 1938	December 1937	January 1937
Engine lathes	$601,088	$487,644	$256,935
Turret lathes	414,747	582,278	259,696
Other lathes	276,880	233,234	139,076
Vertical boring mills and chucking machines	55,326	172,316	164,756
Thread cutting and automatic screw machines	291,171	564,318	257,073
Knee and column type milling machines	447,522	482,717	221,431
Other milling machines	318,557	339,069	283,621
Gear-cutting machines	128,085	312,651	106,925
Vertical drilling machines	30,820	63,265	249,315
Radial drilling machines	48,295	176,639	30,551
Other drilling machines	116,404	255,480	176,130
Planers and shapers	25,101	134,325	70,445
Surface grinding machines	105,288	229,995	115,276
External cylindrical grinding machines	119,915	393,686	101,257
Internal grinding machines	237,360	292,197	110,853
Tool grinding, cutter grinding, and universal grinding machines	186,241	226,488	105,257
Other metal grinding machines	188,251	154,251	109,341
Sheet and plate metal grinding machines	386,725	329,537	408,185
Forging machinery	268,687	243,016	139,301
Rolling mill machinery	1,061,003	1,269,063	251,836
Foundry and molding equipment	148,459	161,859	147,571
Other power-driven metal-working machinery and parts	512,679	616,796	609,789

Other Metal-Working Machinery

	January 1938	December 1937	January 1937
Pneumatic portable tools	88,648	79,289	118,503
Portable and hand and foot operated metal-working machines and parts	92,183	122,083	70,524
Chucks for machine tools	19,452	20,065	17,774
Milling cutters, machine operated threading dies and taps and similar machine operated metal curring tools	48,323	58,334	32,433
Other metal-working machine tools	49,155	79,590	31,643

At one time Germany could not fill foreign orders in less than two years. That she has largely corrected this situation is revealed by the value of her exports of machine tools. In the first nine months of 1937 such sales amounted to 46,000,000 marks, as compared with only 40,000,000 marks in the same period of 1936. To some extent Germany has benefited by governmental preferences in Brazil, one of the best customers of American exporters at the present time, but a new ratio of milreis to reichsmark gives American exporters a better advantage. It is said in some sources that users of German equipment have found out the results of the skimping that has followed Germany's stringent lack of foreign exchange. When German and American equipment of supposedly similar quality start their useful lives at the same time, it is claimed that only a few months are needed to show up wear in the former.

Used Equipment Inquiries

Exceptionally strong inquiries for used equipment are coming from Europe. At least three deals involving $750,000 to $1,000,000 are now being worked upon. Central European countries are responsible for much of the present interest, and their demands for special ordnance machinery are being met with difficulty. Reliable sources say that feelers are being put out for used machines to go to Russia. Many sales could be made to the Chinese were it not for the hostilities. Japan bought approximately 3,000 used lathes in this country during last fall. Argentina, Chile, Brazil, the West Indies, Central American countries and Australia are making inquiries.

The foreign credit situation in South America has improved in the last few weeks. Brazil has been the sore spot. When the Vargas government came in, foreign exchange was suspended for two weeks. This was followed by a period when 90-day contracts for a maximum of $5,000 per day could be undertaken. Since Feb. 16, however, the situation has been much easier. Brazilian importers now pay their banks with drafts in milreis, and the banks settle with New York banks by means of 30-day drafts in dollars. Ready exchange is available in Chile, Columbia and Mexico. Argentina formerly discriminated against American equipment by exacting a 20 per cent foreign exchange premium not applied to other countries. The premium was cut to 10 per cent on Dec. 1.

C. G. CUNNINGHAM

GEORGE H. REAMA

PERSONALS

A. S. GRAY, Insulation Manufacturers' Corp., was elected president of the Machinery Club of Chicago. C. G. CUNNINGHAM, Pratt & Whitney Co., was elected vice-president and A. W. SMITH, L. S. Starrett Co., was elected secretary-treasurer. Directors named were: V. R. CLARK, Victor R. Clark Belting Co.; L. S. NUTTING, Latrobe Electric Steel Co.; FRANK SEESE, Marshall & Huschart Machinery Co.; C. F. STURGEON, Arch D. Corrigan Co.

MR. CUNNINGHAM is sales manager of the Chicago Division, Pratt & Whitney Co., having held that position since Oct. 1935. He was previously in Pittsburgh, and has been with the company since 1927. Mr. Gray succeeds CLYDE BLAKESLEE of the N. A. Strand Co., who was president of the club for two years.

C. O. DRAYTON, formerly general sales manager of the Graton & Knight Co., has gone with the American Screw Co., Providence, R. I. as general sales manager. Mr. Drayton is a member of the executive committee of the American Supply & Machinery Manufacturers' Association.

C. W. ULRICH has been elected vice-president in charge of manufacturing of Altorfer Brothers Co., Peoria, Ill., manufacturers of washing and ironing machins.

WILLIAM H. BLOUNT has been elected president and general manager of Sleeper & Hartley, Inc., Worcester, Mass., builders of spring making machinery, to succeed the late F. H. SLEEPER.

RICHARD D. NUGENT was elected president, Round Oak Co., manufacturer of stoves, furnaces and oil burners, Dowagiac, Mich. He succeeds HARRY HOWARD who becomes chairman of the board.

OTTO MILLER was elected a director, Otis Steel Co., Cleveland, to succeed the late FRANK H. GINN.

JAMES C. FOSTER, formerly general sales manager, Jones & Laughlin Steel Corp., is now president of the Northwestern Barb Wire Co.

GEORGE H. REAMA has been named factory manager for the American Screw Co. Mr. Reama was with the Winchester Repeating Arms Co. from 1911 - 1920, when he was appointed assistant mechanical superintendent of the Corbin Screw Corp. He returned to Winchester in 1923 and remained there until 1934. Lately Mr. Reama has been supervising a General Electric training program.

GREGORY P. GRACE of the Robertshaw Thermostat Co., Youngwood, Pa., was elected chairman of the Pittsburgh Chapter, American Society of Tool Engineers. JAMES P. WILEY, National Tube Co., McKeesport, Pa., was named vice-chairman, while Malcolm F. Judkins, chief engineer, Firthite Division, Firth Sterling Steel Co., was named treasurer, and E. D. GANGWERE, Westinghouse Electric & Mfg. Co., was named secretary.

C. A. DUNDORE, of the Underwood Elliott Fisher Co., was elected chairman and B. PAGE of the Bullard Co., vice-chairman, of the Brdgeport Chapter, American Society of Tool Engineers, at the February meeting. H. DEANGELIS of the Locke Steel Chain Co., and H. CARTER of the Singer Mfg. Co., were elected secretary and treasurer respectively.

HENRY BUTLER ALLEN, director and secretary of the Franklin Institute, Philadelphia, was awarded an honorary degree of doctor of science by Temple University in recognition of his outstanding work with the Institute. Previous to his present connection Mr. Allen was for many years chief metallurgist of Henry Disston & Sons, Inc., he still is counselor in connection with metallurgical developments.

JOHN S. BARTEK, tool engineer, Consolidated Machine Tool Corp., was elected chairman of the Rochester Chapter of the American Society of Tool Engineers at the charter meeting, Feb. 25. CHARLES E. CODD, master mechanic, the Ritter Dental Mfg. Co., was named vice-chairman. JOHN C. DENSE, manager, tool division, Delco Appliance Division, General Motors Corp., was elected treasurer, and MILTON L. ROESSEL, tool engineer, Eastman Kodak Co., was elected secretary.

F. H. McCORMICK, chief engineer, electric range engineering department, has been appointed manager of the appliance engineering department, Frigidaire Corp., to succeed EDGAR A. FISHER. Before joining Frigidaire several years ago, he was assistant chief engineer of Edison General Electric Appliance Co.

S. R. THOMAS has been appointed chief engineer of Bantam Bearings Corp., South Bend, Ind. For the past year and a half Mr. Thomas has been manager of the Automotive Bearing Division, coming to Bantam after an association of four years with the Cord interests.

J. A. COMSTOCK has become associated with the Surface Combustion Corp., Toledo, Ohio, as consulting metallurgist. In particular, his duties will be the investigation and development of metallurgical processes utilizing furnace atmospheres. During the last four and a half years he served as metallurgist for the Illinois Tool Works, Chicago.

WM. H. HART, formerly vice-president and secretary, Hart & Cooley Co., Inc., New Britain, Conn., was elected president to succeed NORMAN P. COOLEY, resigned because of ill health.

W. B. TODD, formerly vice-president of Jones & Laughlin Steel Corp., has just been appointed foreign representative of the American Steel Export Association with headquarters in London, and went abroad on March 1 to represent the American steel industry in foreign dealings.

CHARLES C. NOBLITT, plant manager of the Seymour, Ind., plant of Noblitt Sparks Industries, Inc., and DELMAR McWORKMAN, manager of the plants at Greenwood and Franklin, have been elected to the board of directors.

BUSINESS ITEMS

Bemis & Call Co., Springfield, Mass., will manufacture and market all products of the Sesamee Co. of Hartford, makers of keyless locks, in addition to its regular line of adjustable wrenches. Bemis & Call was recently purchased from the estate of the late HOWARD R. BEMIS by PORTER CHASE, president of Sesamee Co. Officers are: president and treasurer, PORTER CHASE; vice-president and general manager, HOWARD A. LINCOLN; assistant treasurer, JOHN C. BEGGS.

The Screw Machine Products Co. is now occupying a new plant at 4051 South Iowa Ave., Milwaukee, Wis.

Linderme Tube Co., Cleveland, manufacturers of seamless brass, copper and aluminum tubing, has started construction of a new factory at East 219th St. and Nickel Plate Railroad.

The Harris Caravan & Coach Co. plant, Elkhart, Ind., soon will be established in the former Clizbe Mfg. Co. buildings in Plymouth, Ind.

Warner Automotive Products Corp. will open a factory at Auburn, Ind. about April 1, in the old Auburn Automobile Co. plant. The company will purchase part of its equipment from the Warner Gear Co. at Muncie.

J. K. FITZGERALD

A. J. HILDENBRAND

Niagara Machine & Tool Works, Buffalo, N. Y., has opened a factory branch office in the Leader Bldg., Cleveland, Ohio with J. K. FITZGERALD as district sales manager. Addition of this branch to those already established in Detroit and New York, expands Niagara personal service to industries requiring presses, shears and machines for shearing, blanking, drawing and forming metal sheets and plates.

R. G. Haskins Co., Chicago, Ill., manufacturer of flexible-shaft machinery and high-speed tapping equipment, has appointed RICHARD W. ZIEGLER, 1217 East 3rd St., Dayton, as representative in the southern half of the state of Ohio.

Barney Machinery Co. has removed its offices to 537 Union Trust Bldg., Pittsburgh, Pa.

LYMAN A. SMITH has opened offices as a manufacturers' representative at Rooms 437 - 438 Capitol National Bldg., Hartford, Conn. He will represent the Chas. G. Allen Co. for drilling and tapping machines, the Kingsbury Machine Tool Corp. for full and semi-automatic drilling, tapping, threading and milling machines, The Monarch Machine Tool Co. for lathes, and the Van Norman Machine Tool Co. for universal milling machines.

The Morse Chain Co. has placed ARTHUR F. WESTON in charge of the Chicago Office, transferring him from Cincinnati. WM. C. GILBERT, formerly of Detroit, has gone to Chicago, and C. A. SHETTER, formerly of Cleveland, is now manager of the Cincinnati Branch. LON SLOAN, formerly special development engineer at Chicago, becomes manager of the Cleveland Office.

Anton Smit & Co., New York, N. Y., industrial diamond merchant, is celebrating the 30th anniversary of its founding. LEONARD J. A. SMIT is managing director of Anton Smit & Co. of Antwerp and New York, and F. Ls. MEYJES is in charge of the firm in New York.

The Curtiss Aeroplane Div., Curtiss-Wright Corp., will start soon construction of two new machine shop additions to its Buffalo plant.

OBITUARIES

ANTHONY J. HILDENBRAND, purchasing agent for the Cincinnati Milling Machine Co. for 19 years, died Feb. 20 at the age of 41. Mr. Hildenbrand started in the purchasing department under PHILIP O. GEIER, now chairman of the board, and became purchasing agent in 1919 at the age of 23. During the record-breaking flood of January, 1937, Mr. Hildenbrand worked unceasingly to set up almost overnight a relief station in the company plant for 200 refugees, driven from their homes by the Ohio River.

JACOB S. DISSTON, 76 retired vice-president of Henry Disston & Sons, Inc., Philadelphia, died at Clearwater, Fla., February 28. Mr. Disston was the son of HENRY DISSTON who founded the firm in 1840.

EDWARD G. HERBERT, head of the firm of Edward G. Herbert Ltd., Manchester, makers of metal-sawing machines and other equipment, died Feb. 9 after a long illness. Mr. Herbert presented several papers before British and American Technical Societies concerning his researches on work hardening and the cutting properties of tools, and was a contributor to *American Machinist*. He invented the Pendulum hardness tester and the Cloudburst hardness machine.

ISAAC F. BAKER, 87, former general superintendent of the Lynn Works, General Electric Co., died Feb. 17.

PAUL H. DIVER, magnet sales manager since organization of The Ohio Electric Mfg. Co., Cleveland, died Feb. 26.

CHARLES D. HOGATE, 60, superintendent of rolling stock and equipment, Indianapolis Railways, Inc., died after a long illness.

HARRY A. LUND, 43, president of the Truck & Trailer of Indiana, Inc., Elkhart, committed suicide recently.

HENRY LEWIS DEVRIES, 53, plant superintendent of the Metal Products Corp., Indianapolis, died recently.

SHOP EQUIPMENT NEWS

Michigan No. 860 Gear Finisher

Designed for use where limitations on production quantities or requirements for finishing wide varieties of gears on one machine do not permit taking full advantage of the maximum economies possible on a rack-type finisher, the No. 860 gear finisher announced by Michigan Tool Co., 7171 E. McNochols Road, Detroit, Mich., is of the single rotary cutter type. It operates on the cross-axis principle developed for use on rack-type finishers. Cutter and gear rotate in mesh on different axes, so that as they rotate there is a sliding action diagonally across the face of the gear tooth. Serrations on the cutter teeth faces, on both sides of the cutter teeth, shave off excess material as the result of this motion.

In operation, the gear is loaded into the machine on arbors or between centers. Pushing the control button starts rotation of the cutter, driving he gear with it. As the cutter revolves, the table carrying the cutter is fed away from the operator toward the rear of the machine until the cutter has passed the point where center distances between the cutter and gear reach the minimum, and the gears are properly sized. At this point the table feed reverses automatically, carrying the cutter back through the maximum depth of contact with the gear. The machine stops automatically for reloading.

Cutter teeth are serrated in such a manner that the same cutting action takes place on both sides of the land between the serrations. This action is said to prevent undesirable burnishing or cold working of the metal on the surface of the teeth being finished. To set up the machine, the table is raised or lowered to the required center distance and the cutter spindle is set by means of a sine-bar in addition to a scale and vernier. A swivel mounting for the cutter head permits finishing of either right or left-hand gears.

The No. 860 machine is available in two sizes for gears of 8 and 12 in. maximum diameter. Adjustment of table travel feed is by change gears, while distance of travel of the table is adjustable by means of electric controls for the automatic cycle. Each machine is driven by a 3 hp., 1,200 r.p,m. electric motor. Over-all dimensions are 32 in. wide, 50 in. deep and 70¾ in. high. Work height is 48½ in. and net weight of the machine is approximately 4,600 lb.

Peters Vertical Tool Grinder

Peters Tool Co., Inc., 114 East Scott St., Milwaukee, Wis., is exhibiting this vertical tool grinder at the Machine & Tool Progress Exhibition in Detroit. The vertical grinding spindle can be adjusted to give a short oscillatory movement, thus eliminating lines in ground parts. This movement can be stopped for using form wheels or to dress the wheel with a diamond.

Table of grinder can be adjusted approximately 10 deg. above or below its horizontal position, thus permitting the grinding of desired relief

on die parts. These grinders are equipped with V-belt drive and are powered with a 1½ hp. ball bearing motor. Wheel speed is set at 5,000 r.p.m. Approximate weight of machine is 925 lb. and floor space dimensions are 24 x 34 in. Standard grinding wheels are used.

Southwark Hydraulic Bushing Press

Designed to exert a maximum pressure of 10,000 lb. and driven by a ¾ hp. motor, this automatic hydraulic bushing press built by Baldwin-Southwark Corp., Philadelphia, Pa., is arranged specially for assembling a pressed-on bushing on the drive axle in an automobile manufacturing plant. Both axle and bushing are machined to close tolerances, but an extreme minus tolerance axle assembled with an extreme plus tolerance bushing gives a loose fit, while the opposite conditions produce a very tight fit. These conditions often result in loose or split bushings.

A press fit requiring 3,000 lb. minimum and 6,000 lb. maximum was found by experiment to give a satisfactory and reliable assembly. This press was designed with automatic features which meet the requirement

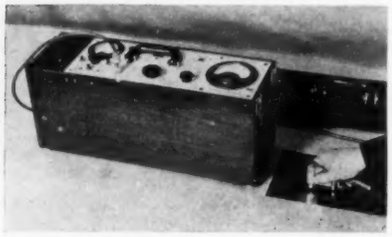
that the loose bushing should not be bottomed against the shoulder of the axle, but should stop within $\frac{1}{4}$ in. of the shoulder so as to permit the easy removal of the bushing and to allow reclaiming it. If the pressure at any point of the forcing stroke but $\frac{1}{4}$ in. from the end of the stroke is below 3,000 lb. or exceeds 6,000 lb. the press will stop and cannot be made to continue.

Machine is placed directly in the production line for these axles, and the operator simply slips the bushing over the axle, places it into the machine, which performs the forcing operation, and then the operator again suspends the assembled axle and bushing on the conveyor. Any assembly which requires less than 3,000 lb. or more than 6,000 lb. has the bushing $\frac{1}{4}$ in. or more from the shoulder of the axle. When these axles reach the general drive assembly they are easily noticed, since they cannot be used. They are placed aside, the bushings are pressed off, and axles and bushings are reclaimed.

P.R. "Profilometer" Surface Comparator

Designed for the rapid measurement of surface roughness, particularly on fine machined surfaces produced by grinding, honing and lapping operations, the "Profilometer" offered by Physicists Research Co., 337 S. Main St., Ann Arbor, Mich., can be used on flat, cylindrical or curved surfaces of a wide variety of size and shape. It does not scratch or otherwise damage the surface. This instrument consists of two parts: (1) a tracer unit shown held in the hand, and (2) an instrument box. In the box is a meter calibrated directly in micro-inches, (0.000001 in). The tracer unit is moved across the surface to be measured and the meter gives a continuous running root-mean-square average of the height of the surface irregularities. Reading obtained is independent of the speed of trace, and the tracer can be moved manually or mechanically. For most work, a rate of trace of about 1 in. per sec. is convenient.

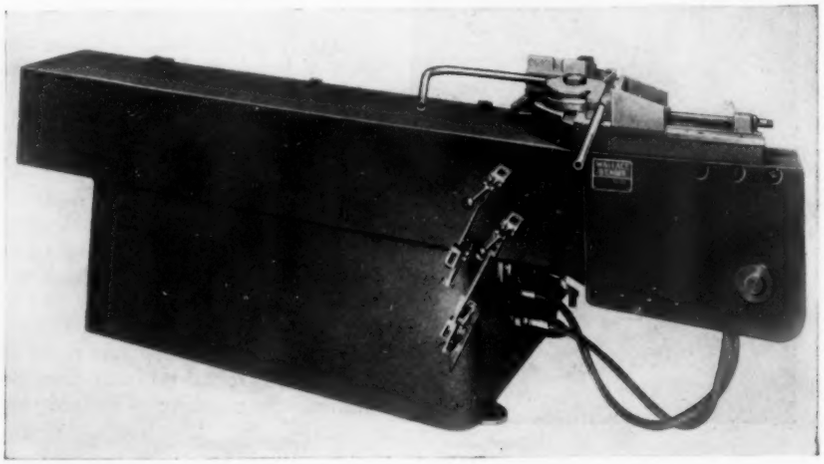
Details of the tracer can be modified depending on the type of surface to be measured and the instrument box can be arranged either for portable use or for panel mounting. On most surfaces, the irregularities which constitute the roughness are only a few thousandth of an inch across, and the instrument is designed to measure irregularities whose widths do not exceed $\frac{1}{32}$ in. Longer waves, curative of the surface, do not record on the meter and, accordingly, the roughness of such surfaces can be measured without influence from the curative of the surface. By means of a selector switch, the sensitivity of the instrument can be adjusted so that its full scale reading is 3, 10, 30 100, 300 or 1,0000 micro-inches. This range has proven sufficient for present-day surfaces. Overall dimensions of the box for the Model P "Profilometer" are approximately 7 x 10 x 22 in. Weight is 50 lb. In case a sensitivity of 10 micro inches, full scale, is sufficient, the instrument can be reduced appreciably in size and weight. Primary over-all calibration is provided at the laboratory against measured displacements of the tracer point. Convenient secondary calibration of the amplifier is provided as part of the instrument.



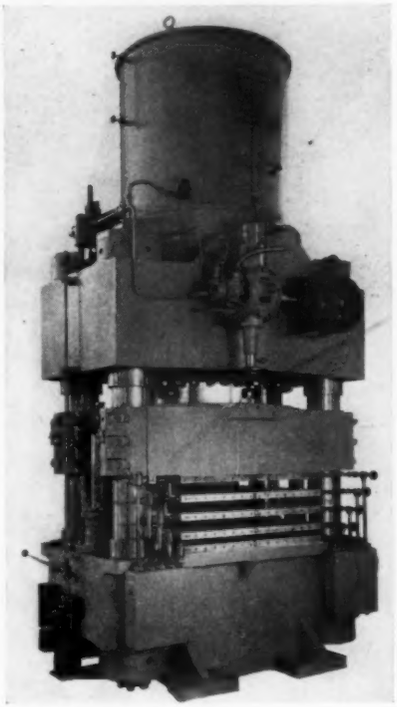
Wallace Series 500 Automatic Hydraulic Tube Bending Machines

Available in 44 production ranges, the Series 500 automatic hydraulic tube bending machines offered by Wallace Supplies Mfg. Co., 1310-12 Diversey Parkway, Chicago, Ill., have capacities ranging from $\frac{1}{4}$ to 8 in. diameter extra-heavy pipe. All hydraulic control valves are located within the oil tight body of the machine and all parts of the machine cycle are controlled by two hand levers operating pilot valves. Production capacity ranges to 300 or more bends per hour in the No. 502 machine, which has capacity for 2 to 3 in. tubing, to a production of 4 bends per hour on the 8-in. extra-heavy pipe.

No gaskets or packings are used on the work-end of the cylinders. All hydraulic working parts are inclosed within the all-steel base. A mandrel unit for light-wall tubing, extruded, rolled or pressed sections is available as optional equipment. These machines are built in two styles for 90 or 180 deg. angle bends, adjustable for any degree of rotation within the capacity of the machine. These machines are recommended for



cold bending pipe, conduit, structural shapes, I-beams, channels, extruded sections, rolled moldings, solid bars, flats, round, and squares in all ductile metals.



H-P-M 1500-Ton Hot-Plate Press

A vertical, downward-acting, open-rod type hot-plate hydraulic press of 1,500 tons pressure capacity has been developed by the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. This unit has a closed-top pedestal bed. Platen is actuated by one main ram and two auxiliary "Fastraverse" rams. Pressing surface of the platen and bed is 48 x 48 in. Five hot plates of the same dimensions and 2-in. thick are equally spaced between the platen and the bed. The "Fastraverse" operating system includes a Model 4R radial pump directly connected to an electric motor and mounted overhead on the press to make the installation self-contained. This pump is a high speed unit of the radial plunger, oil pressure type.

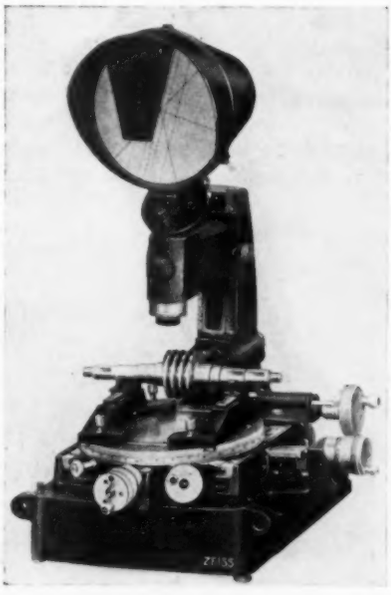
Ludlum "Ludlite"

"Ludlite," a composite product announced by Ludlum Steel Co., Watervliet, N. Y., consists of an outer surface of thin stainless steel and a backing of tough, flexible, non-metallic material. It is claimed that the "Silcrome" stainless steel and the flexible backing are permanently bonded through heat and pressure in a special manufacturing process. The backing material affords support to the steel and makes it possible to cement the Ludlite to plaster, wood, fiber board, concrete and other surfaces. This material is being produced in rolls 2 ft. wide and in lengths of 50 and 100 ft. It can be cut on the job with heavy scissors and can be easily shaped and cemented, nailed or screwed in place. It is easily stamped, cut or formed.

Zeiss Precision Optical Instruments

A number of new and improved models of precision optical instruments have been announced by Carl Zeiss, Inc., 485 Fifth Ave., New York, N. Y., and will be displayed at the A.S.T.E. exhibition in Detroit. Among these instruments is the large toolmaker's microscope, Fig. 1, which has a built-in, rotary graduated table, with a longitudinal travel of 6 in. and a transverse travel of 2 in. Magnifications of 10X, 15X, 30X and 50X are available. Rectangular and polar-coordinate measurement of templets, contour gages, form tools and milling cutters, punches and dies, and parts of a similar nature can be done with this machine. It also will measure threads to 2 in. for diameters, pitch and lead, angle of thread, position of angle relative to thread axis and form of thread. This instrument is claimed to be accurate to within $\pm$ 0.001 in. when using the compound stage micrometers. It is accurate to within $\pm$ 1 to 2 min. of arc when using the ocular protractor. Circular table may be read to 0.10 deg. with the aid of a vernier. Instrument may be fitted with a projection attachment which is placed on the microscope tube and furnishes a ground-glass image of the same magnification as that seen in looking through the ocular.

Fig. 1—Gages, taps, dies, hobs, worms, templets and form tools may be inspected with the Zeiss large toolmaker's microscope



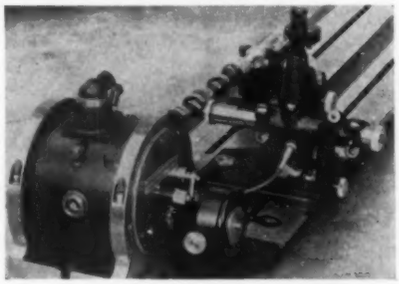


Fig. 2—Camshafts for all types of motors, as well as master cams, may be checked with the Zeiss camshaft tester, on which improvements have been announced

The improved camshaft tester, Fig. 2, is designed to provide a rapid, high-precision means for determining the form and angular relation of the lobes of cams of all kinds. Direct readings may be made on the glass master scale and spiral optical vernier to 0.00005 in. Calculations are said to be facilitated by an improved means for setting the master scale to zero, or to a round figure.

Fig. 3—Accuracy of angular measurement is said to be assured by a divided glass circle and reading microscope in the Zeiss optical circular table

An optical circular table, Fig. 3, is recommended for jobs on precision machine tools, such as jig borers, for the production of holes whose locations are stated in terms of polar coordinates. Coarse setting is effected by reference to a scale on the outer circumference while high accuracy of division is insured

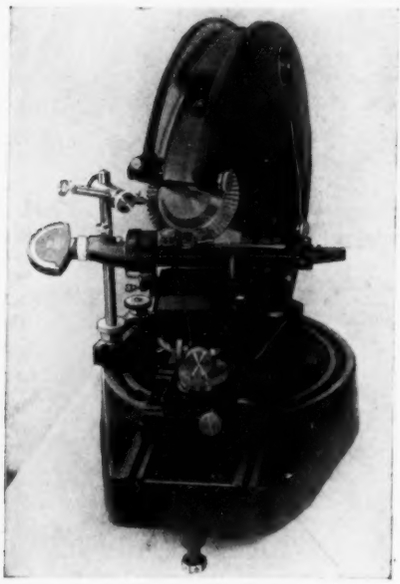


Fig. 4—Gears of all types, gear cutters and notched index plates may be inspected on the Zeiss gear tester

by the employment of a glass circle and reading microscope similar to the arrangement used in the optical dividing head. Working precision ranges to ± 10 sec. of arc. A centering microscope, suitable for centering the circular table relative to the spindles of machine tools is available. The circular table has an effective diameter of 16 in., and is approximately 7 in. high, including the illumination unit and center with lifting device. Net weight is 242 lb.

Accurate analysis of individual gear errors by checking component elements is possible with the improved gear testing machine, Fig. 4. This is accomplished by checking the base circle pitch, tooth thickness and concentricity of the tooth. Readings to an accuracy of 0.00005 in. are claimed to be possible. Two "Orthotest" feeler gages have been built into this instrument. Gears up to 16 in. in diameter can be mounted in the supporting frame. Above that size, the measuring slide may be used separately from the frame. Spur, helical, bevel, hypoid and worm gears, as well as Fellows gear cutters can be measured in this instrument. Vertical adjustment is 6 in.

H.E.S. No. 3 Reaming And Tapping Machine

Speeds of 200 to 4,000 r.p.m. are available through changing the pulleys of the V-belt drive on the No. 3 reaming machine offered by Hole Engineering Service, 308 Stormfeltz-Lovely Bldg., Detroit, Mich. Reaming, chamfering, burring, tapping and special milling operations can be performed. This machine is being shown at the A.S.T.E. exhibition in Detroit.

A feature of the construction of this machine is the round bar guides upon which fixtures can be mounted to present work in accurate alignment with the spindle. Brackets on the headstock, carrying these guides are reversible from side to side so as to locate the bars on the spindle center-line or below, as shown. A lever feed table also can be provided for mounting on these guides. Large keyway running the length of the table surface provides a means for locating special fixtures. Cutting lubricant chamber in the base of the machine has an outlet connection for a motor pump at the back.

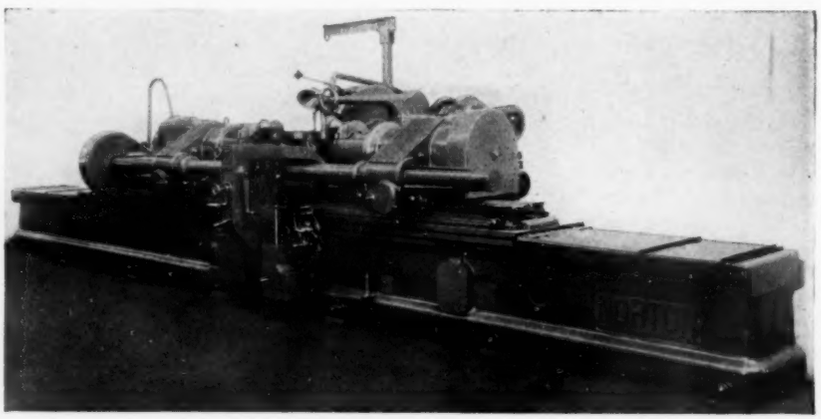
Norton 24-In. Heavy-Duty Double-Head Crankpin Grinder

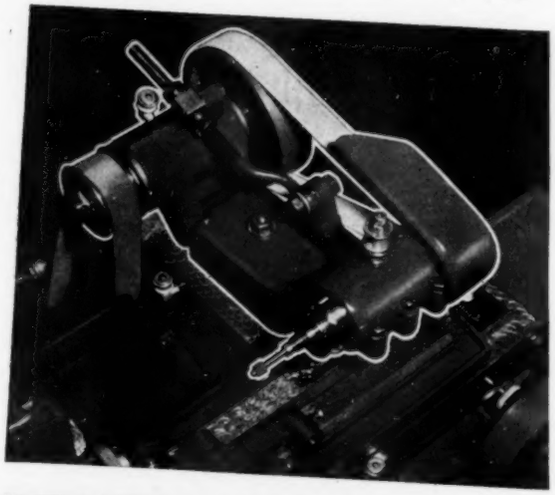
Designed for grinding Diesel, truck, tractor and marine engine crankshafts which exceed the capacity of standard automotive crankpin grinders, this 24-in. grinder offered by Norton Co., Worcester, Mass., permits grinding all crankpins on a shaft without removing the shaft from the machine. Workheads are movable along the table to accommodate various lengths of shaft within the capacity of the machine. Power for the work drive is transferred from the motor on the left end of the table through a shaft enveloped in a hollow, splined drive shaft to a point midway between the work heads. Drive shaft then drives each work head spindle through sprockets and silent chains. Drive torque thus its equalized and excessive strain on the crankshaft is prevented.

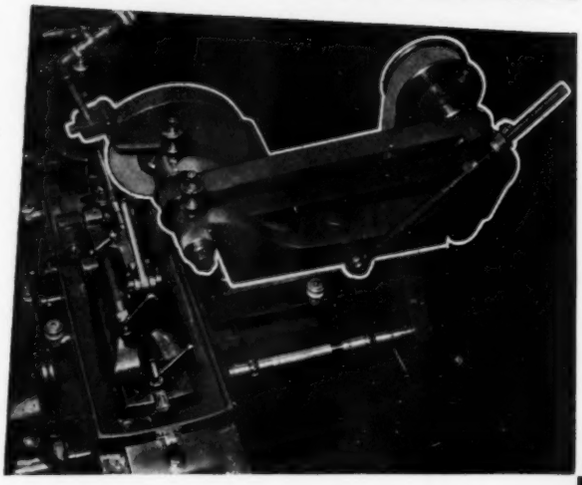
A rapid wheel head traverse is combined with a shoulder feed in an independent mechanism which moves the upper portion of the compound wheel slide through a special screw and half nut. Two speeds are available, a shoulder feed of 1 in. per min., and a rapid traverse of 50 in. per min. A friction drive sheave acts as a safety device.

One lever and two hand wheels control all the machine's main functions. Control is interlocked so that the table cannot be moved at its rapid speed while the wheel is between the two cheeks of a pin, nor can the table be moved at all when the power wheel head traverse is in use. Table is moved rapidly from one grinding position to the next as successive pins are ground, but is decelerated by the operator through the main control lever as the position of the pin opposite the grinding wheel is approached. Location of the table is by means of pointers on the table spaced to correspond with the centers of the crankpins and a pointer on the base directly opposite the center of the grinding wheel. Positioning of the wheel can be accomplished rapidly.

Direct motor drive is provided for the grinding wheel spindle, the power table traverse, the work drive,







Internal-External Grinding

INTERNAL GRINDING

Internal spindle is driven by belt from main drive motor, as shown at left above, at speeds up to 35,000 r.p.m. Holes from the smallest up to 3" diameter can be ground with maximum 4" power or 11" hand table reciprocation.

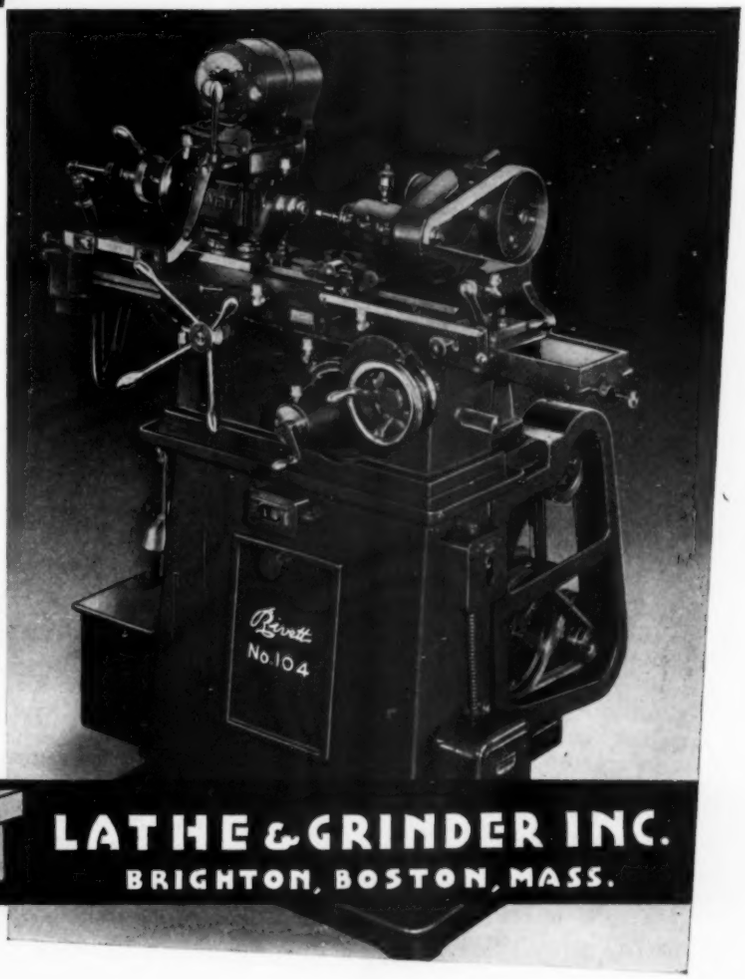
EXTERNAL GRINDING

External grinding attachment readily interchanges with internal spindle bracket on the cross slide, as shown at left, and is used for grinding straight and taper diameters or bevels. A wheel up to 6" maximum diameter by 1/2" face can be used.

RIVETT No. 104 GRINDER

is designed to meet the demand for a small grinder suitable for precision tool making and accurate manufacturing. It may be used as a single-purpose production machine or for the many internal and external grinding requirements of the tool room. Its ease of set-up and wide range of adjustment make it more economical on small lots of parts than a heavier machine.

Although primarily an internal grinder, an external grinding attachment is offered to interchange with the internal spindle bracket. The Rivett fixed diamond is used both for truing either internal or external wheels and for maintaining sizes on duplicate work. For further information write for bulletin 104-C.



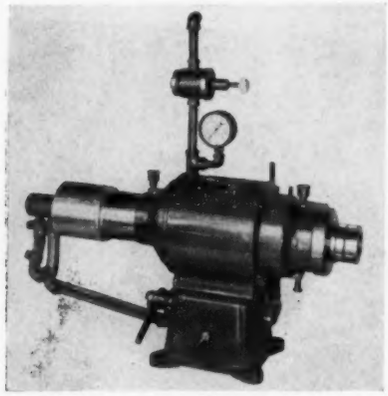
RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

the power wheel head traverse, the coolant pump and the force feed lubrication pump. Machine is equipped with grinding wheels up to 42 in. diameter, swings work 24 in. diameter over the table and takes 120 in. between heads. It occupies a floor space of approximately 11 x 37½ ft. and weights about 50,000 lb. with standard equipment and motors.

Schauer Speed Lathes

Recommended for use in finishing ball bearing races, spinning ring shafts, screw machine products, or burnishing wire drawing dies and for metal spinning, the improved bench lathes offered by Schauer Machine Co., 2060–68 Reading Road, Cincinnati, Ohio, are designed for bench mounting. They may be provided with legs for floor mounting. Finishing, polishing or lapping operations can be performed.

Construction embodies a two-speed motor totally inclosed and ventilated, an automatic brake and necessary chucking equipment. Overload protection to the motor is provided by a two-pole thermal switch. Speed change is accomplished by



using a double-wound a. c. motor with a toggle-type speed switch.

These lathes are built in two frame sizes to give a range of ⅛ to 1 hp. Motors can be provided with speed combinations of 575-1,150, 875-1,750, 1,750-3,500, and, for 220 volts d. c., for 1,350-2,700 r. p. m. Special Type NA1A units shown, have air-operated expanding mandrels. Pressure gage and pressure control are provided. Motor and brake ar controlled by a hand lever at the rear of the machine. Automatic brake stops the motor when the current is cut off. Unit is designed to take collets from 1/64 to 1¼ in. round, as well as step chucks, special mandrels and holders. This lathe is being shown at the A.S.T.E. exhibition in Detroit.

Buffalo No. 3 Adjustable Horizontal Bending Rolls

Improvements in design of the No. 3 horizontal bending rolls have been announced by Buffalo Forge Co., 448 Broadway, Buffalo, N. Y. Main roll drive is directly coupled through a flexible coupling to the vertical shaft of a speed reducer. This is said to provide a compact and trouble-free drive. The vertical spur-gear reducer takes the entire reduction in a single housing, all gears and bearings running in a bath of oil. Drive unit is located in a closed pit below the floor line.

A built-in oil pump on the reducer unit circulates lubricating oil over the gears and bearings. Flexible couplings used both on the motor and drive side deliver torque directly to

the roll pinion shaft, cushioning the impact due to frequent reversals of the rolls. The unit shown has a capacity for bending 6 x 6 x ⅞ in. angles leg out to a 60-in. diameter, or 6 x 6 x ½ in. angles to a 72-in. diameter, leg in. It is driven by a 30 hp. motor and the complete unit weighs 33,000 lb. Over-all dimensions are 114 x 102 x 150 in. This unit is arranged for power adjustment of the adjustable roll by means of a compact geared arrangement having a reversible motor.

"Doall" No. V-16 Contour Machine

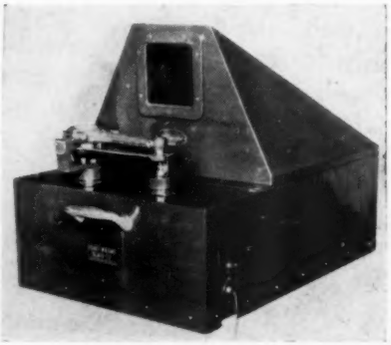
Continental Machine Specialties, Inc., 1301 Washington Ave. S., Minneapolis, Minn., has announced development of the No. V-16 "Doall" contour machine for toolroom use. This unit has a throat capacity of 16 in. and two ranges of infinitely variable speed. It incorporates many of the features of the larger "Metalmaster" machine, such as an automatic butt welder and a four-way tilting table. A two-piece file backing member makes it unnecessary to remove any parts for internal filing operation.

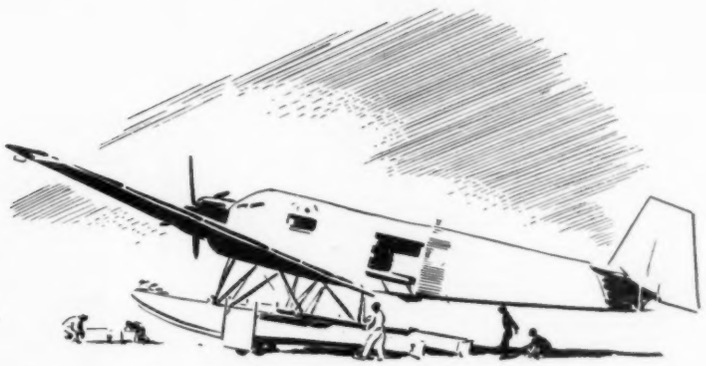
Low range of speed is 75 to 450 ft. per min., while the upper range

is from 450 to 2,800 ft. per min. This makes it possible to use the machine for sheet metal fabricating as well as for toolroom work. A "Job Selector" indicates the correct speed to use for each job,. whether sawing, filing or polishing.

Special "Shadowgraph" For Connecting Rods

The double connecting rod shadowgraph being shown at the American Society of Tool Engineers' exhibition in Detroit by The Exact Weight Scale Co., Columbus, Ohio, features a three-point suspension for the rod holders with centers the same as the rod centers. This unit has carrying handles at the front and the rear and is equipped with a 16-gage steel housing equipped with a spring locked hood. Bearings of this





PULLING A STRANDED PLANE OUT OF THE FROZEN NORTH

...with a Toolroom Job in Rhode Island

Down in the bush with a broken connecting rod . . . thousands of miles away from service . . . only days away from the first big snows. Tough spot, and a time fuse on it.

It needed plenty of action to save this crippled plane from being winter-killed . . . and save a freight contract with northern gold mines. But not everyone makes rods for British motors. *And no one turns them out in a day.*

So the airline flashed an S. O. S. to Taft-Peirce in Woonsocket. Eight days later the finished rod — ground and balanced to a hair — was flying north. Two days later the stranded plane was flying south to safety.

Such an incident* highlights the kind of service that T-P has rendered to aviation since the industry was born. And this service extends to all industries . . . provides all the resourcefulness, facilities and engineering "know-how" to pull *you* out of any tough spot in which you may find yourself stranded.

For complete details on Contract Manufacturing and Tool Room Service, write to The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

* *An Actual Case History . . . Names, Dates and Places Furnished on Request.*

TAKE IT TO TAFT-PEIRCE

weighing device are agate and tool steel, while the pivots are of chromium plated hardened tool steel. Weight holders are placed inside the housing and the unit is provided with a chromium plated pin weight for both the heavy end and the light end of the rod.

Dial is graduated to customer's specifications and is 8 in. high and 5 in. wide. Extreme possible travel is 5 in. to 1 oz. or its metric equivalent. The unit shown is arranged for 7 in. minimum and 8½ in. maximum rod centers and weighs 240 lb. Base length is 28 in. and width is 20 in. Over-all height is 22½ in. Light source used with this unit is a single filament lamp operated from a transformer. Rubber cushioned stops are used for quiet operation.

Link Spring-Checkers

A special reverse dial indicator, mounted so as to be adjustable in stops 1 in. apart, is mounted on one of the spring checking devices being exhibited at the American Society of Tool Engineers' Machine & Tool Progress Exhibition by Link Engineer & Mfg. Co., 1054 W. Baltimore Ave., Detroit, Mich. This spring checker, shown in Fig. 1, will handle a spring of 4⅜-in. free height. Indicator has 1-in. travel and permits the reading of compressed height to 0.001 in. over a range of 4 in. Compression head is 1⅝-in. in diameter and the weighing table is 2⅝-in. in diameter.

Fig. 2 shows a standard unit

Fig. 1—This Link spring checker will test springs up to 4⅜-in. free height

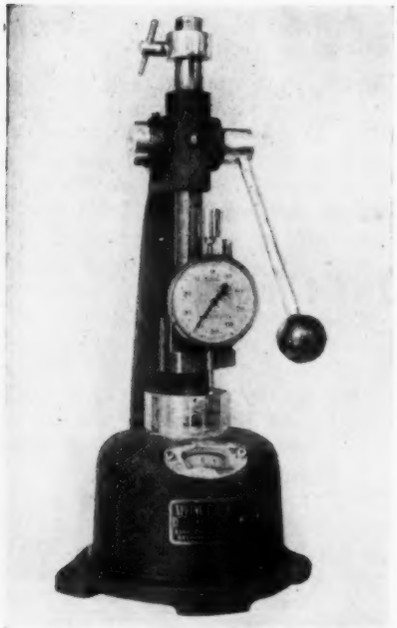


Fig. 2—A "Heightrol" buzzer eliminates the need for a mechanical stop in this Link spring tester

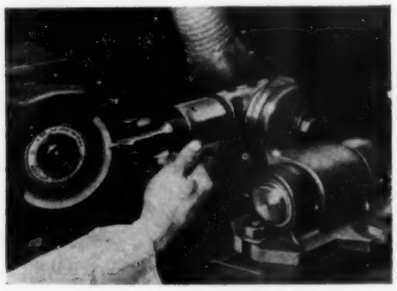
equipped with a "Heightrol" buzzer circuit completed through a pre-set stylus, which is claimed to give accurate control of the compressed height. This eliminates error present when a mechanical stop is used and prevents error in operation due to careless reading of height scale. Only the load dial need be read, as the buzzer sounds when the correct compressed height is reached.

Another unit having electronic control is said to permit the checking of springs at the exact compressed height and shows by indication of Neon lamps whether or not the spring being checked comes within the tolerance limit specified. It eliminates the reading either of height or load dials and makes possible the checking of approximately 1,500 springs per hour.

Putnam Universal Grinding Fixture

A swivel-type universal grinding fixture for use in sharpening end mills and other cutting tools has been introduced by the Putnam Tool Co., 2981 Charlevoix Ave., Detroit, Mich., and is being shown at the Machine & Tool Progress Exhibition in Detroit. Operation of this fixture is based on the same principle as grinding between centers, with the horizontal motion being controlled by movement of the machine table. Each holder unit is furnished with each fixture to cover the entire range of end mill sizes from $\frac{1}{16}$ to 2 in. diameter.

While designed primarily for sharpening end mills, this fixture may be used in regrinding a wide variety of cutting tools. By turning the fixture at a right angle to its usual position on the table, end teeth may be ground. The top section of the fixture, of which the holding unit is a part, may be adjusted for grinding the tool at an angle. Any desired taper may be secured.

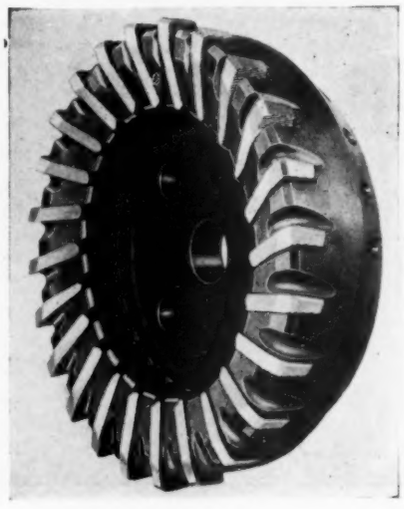


O K Improved Milling Cutters

Among the new tools being exhibited at the Machine and Tool Progress Exhibition this week in Detroit are rough and finish milling cutters having "dual adjustable" inserted blades developed by O K Tool Co., Shelton, Conn. Dual adjustable medium and heavy duty face milling cutters, Fig. 1, have the blades inserted radially into the face of the cutter body. Adjustment to take up wear is obtained by advancing the blades outward one or more serrations, as required. These blades are designed to give four times as much radial adjustment as facial adjustment.

Double adjustment is obtained by making the bottom of the slot at an angle to the body and permits using as much as 65 per cent of the blade.

Fig. 1—OK dual-adjustable medium and heavy-duty face milling cutters are designed to give major portion of blade adjustment on the periphery where the most wear occurs



Mill It Faster . . . Better

. . . *At Lower Cost* . . .

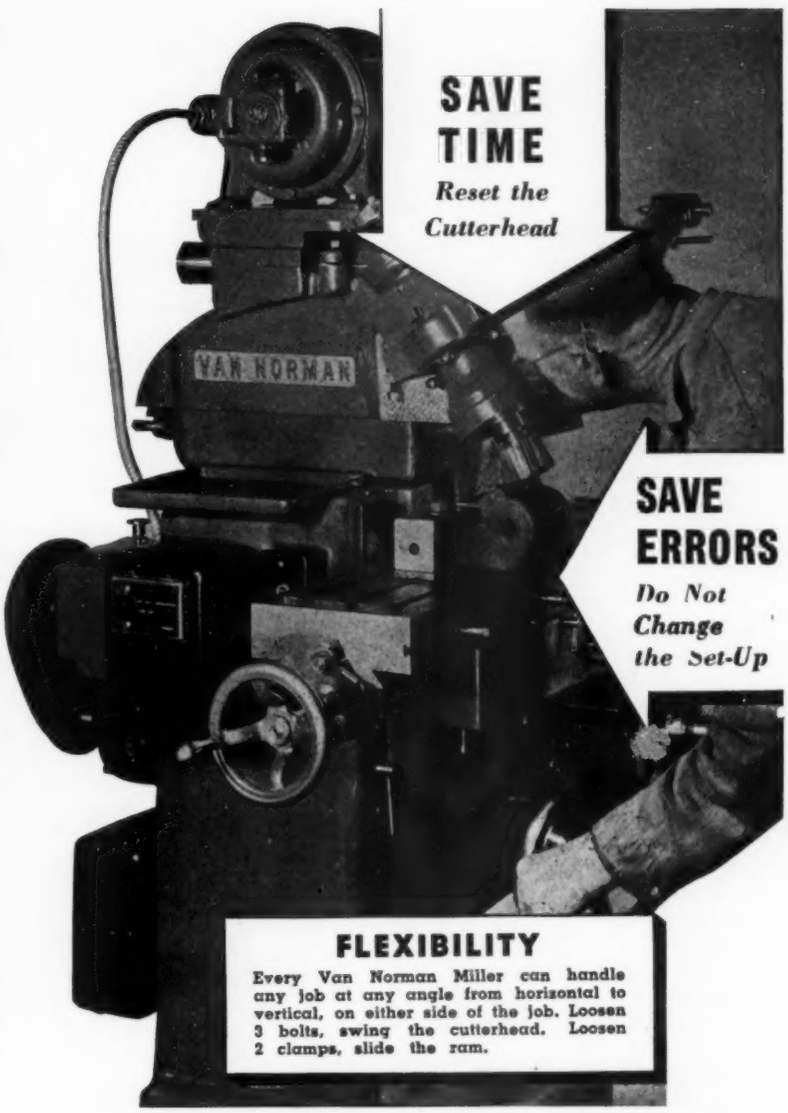
WITH A

VAN NORMAN UNIVERSAL

Van Norman's work-range includes practically all toolroom milling jobs . . . from start to finish . . . *in a single set-up* . . . no matter how many operations are required. Combined adjustments of the exclusive swiveling cutterhead and adjustable ram simplify the milling of all vertical, horizontal and angular surfaces.

Van Norman Universals are the top-rank millers for toolroom service . . . and are also adapted for pattern, experimental, and contract work . . . even short production runs. New speed, new rigidity and new accuracy insures faster work and greater precision. Errors are avoided because set-ups are fewer, and because there's less indicating work to do, less adjusting of fixtures and angle plates.

Find out what Van Norman's famous flexibility can do to increase the quality and quantity of the output of your shop or laboratory. Write for full details on each of the four sizes of Van Norman Universal Millers shown below.



SAVE TIME

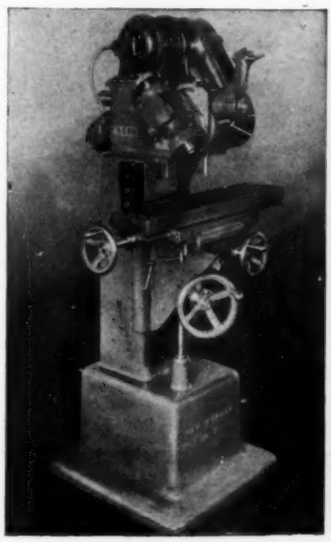
Reset the Cutterhead

SAVE ERRORS

Do Not Change the Set-Up

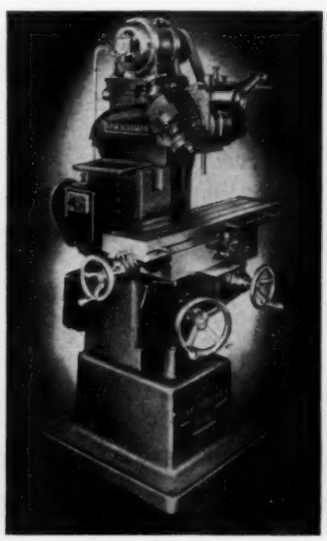
FLEXIBILITY

Every Van Norman Miller can handle any job at any angle from horizontal to vertical, on either side of the job. Loosen 3 bolts, swing the cutterhead. Loosen 2 clamps, slide the ram.



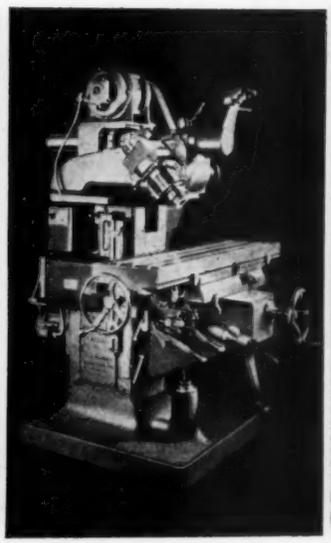
NO. 6

Table Size ..... 30x67⅞"
Feed Range ..... 18x5¾x16¼"
Ram Movement . 11¼"



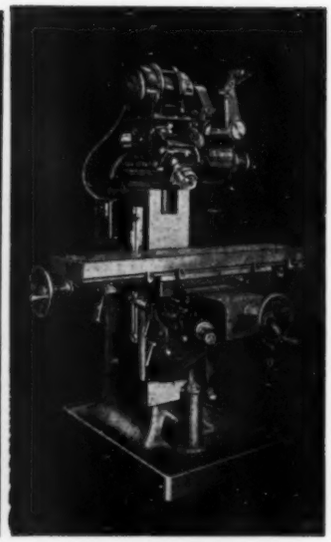
NO. 12

Table Size ..... 37x8⅛"
Feed Range ..... 17x6⅝x17"
Ram Movement .... 12¾"



NO. 22

Table Size ..... 45x11⅝"
Feed Range ... 27½x11x17½"
Ram Movement . 19"



NO. 32

Table Size .... 55x12"
Feed Range ... 34x10⅛x22¼"
Ram Movement . 19"

VAN NORMAN MACHINE TOOL COMPANY, SPRINGFIELD, MASS.

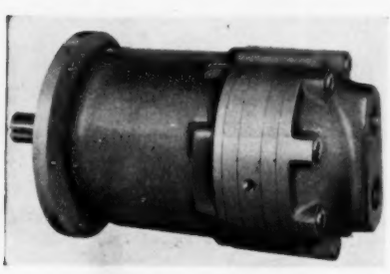
Fig. 2—Finish cutters offered by O K Tool Co. have four times as much facial as radial adjustment

The adjustment is accomplished without wedges, pins or set screws and the blade, tapered toward the bottom, fits into the matting slot of the cutter body. This, together with a series of matting serrations in both blade and slot, is claimed to form a positive lock.

The finished milling cutter, Fig. 2, has blades inserted into the periphery and is recommended for use where a finer finish is necessary than can be obtained with the rough milling cutter. In this cutter, the blades are ground with a slight lead, in order to give the cut a "skiving" action and the major blade wear is on the face. Adjustment of the blades is accomplished by advancing them faceward one or more serrations, the same dual automatic principle obtaining here as in the roughing cutter.

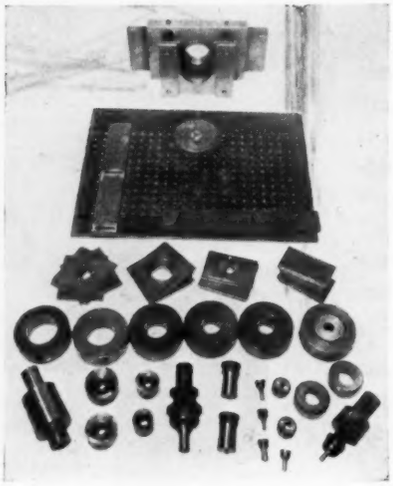
Sundstrand Two-Speed Fluid Motor

A two-speed oil-power fluid motor of the multiple piston type is offered by the Sundstrand Machine Tool Co., Harrison and 11th Sts., Rockford, Ill.



Designed especially for machine tool feed applications, the two speeds in this motor permit using the low speed for feed movements to slides, carriages and tables, while the high speed supplies rapid traverse. Two torque ratings for the two speeds are provided.

A feed range from 3 to 120 r.p.m. and a rapid traverse rate of 2,000 r.p.m. can be obtained by driving this motor with the same standard pumps used to provide feeding movements by means of a piston and cylinder. Unit shown is the Model 4-MC, which has a rating of 100 in. lb. per 100 lb. pressure for feed. This unit is 6½ in. in diameter across the face of the flange and 9½ in. long, overall.



"Semco" Universal Piercing Dies

A group of standard Semco universal piercing die sets are offered by the Service Machine Co., 752 Broadway, Elizabeth, N. J. This line includes three standard styles intended for single-hole piercing in large sheets or small parts. Table shown is standard for the Model A set only, gaging for Models B and C combines a single back and end gage.

Model A will take any punch size from ⅛ to 3½ in. diameter, while Model B will take from ⅛ to 2¼ in. and Model C is intended for ⅛ to 9/16 in. or from ¼ to ¾ in. punches. Slots or special shapes of punches and dies may be accommodated within the diameter range. Stripper or plate adapters are furnished for each punch size, as are the necessary bushing adapters for dies. Punches and dies can be interchanged readily and stripper plates will slide out with the punch.

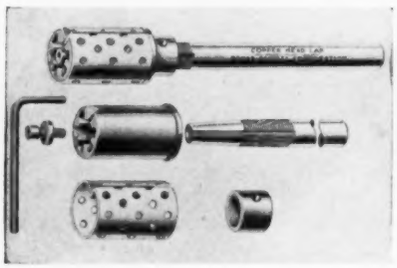
Binks Portable Spraying Outfits

Available in six different types of mountings, portable paint spraying compressors equipped with all necessary accessories are offered by Binks Mfg. Co., 3114-26 Carroll Ave., Chicago, Ill., for production and maintenance painting operations. A two-wheel hand cart style is shown. This unit can be furnished with steel wheels or pneumatic tires and is easily portable. It is available for gasoline engine or electric motor outfits ranging in size from 1½ hp. to 6 hp. for differing applications.

F.-G. Rotary Drill Rod Rack

Drill rod rack No. DRR-120-A, announced by The Frick-Gallagher Mfg. Co., Wellston, Ohio, is a two-section unit, each section revolving either way. This unit can be placed in the corner, against the wall, or wherever wanted, and can be ap-

proached from any angle. The bottom section is 34 in. in diameter and the top section 28 in. Each section has 60 compartments, making a total of 120 compartments available for use. This unit is being shown for the first time at the A.S.T.E. show in Detroit.



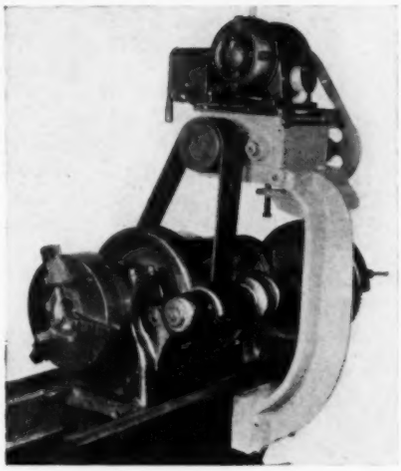
B.-S. Copper-Head Expansion Laps

Entire wear of the copper-head lap units offered by Boyar-Schultz Corp., 2110 Walnut St., Chicago, Ill., is taken by the replaceable copper sleeve. This sleeve can be removed quickly for substitution of a new sleeve which already has been sized. Abrasive mixed with a lubricant of the vaseline type is applied to the surface of the copper sleeve while the lap is in motion and will cover its entire surface, nesting in the pockets formed through the perforations of the copper sleeve. Rotation of the lap; combined with a reciprocal up-and-down motion is claimed quickly to produce a smooth lapped finish. Expansion-type laps are available in sizes ranging from 1 to 2 in. in $\frac{1}{16}$-in. step. One-piece, split lapping arbors having replaceable copper lapping sleeves are available in diameters ranging from $\frac{1}{8}$ to 1 in. in $\frac{1}{32}$ in. steps.

"Production" Type 1136 Four-Speed Drive

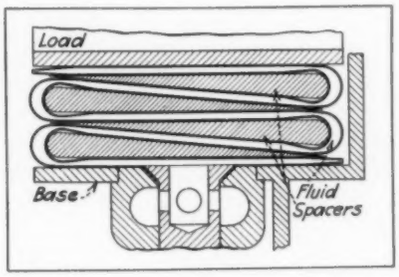
Using a four-speed, quick-change gear box which is driven by a standard motor, the Type 1136 drive announced by The Production Equipment Co., 5219 Chester Ave., Cleveland, Ohio, is designed for use in motorizing machine tools. Pulley on the output shaft drives to a single step on the machine cone pulley. Drive between motor and gear box is by V-belt. Gears slide on splined shafts mounted in ball bearings.

Various types of supports can be supplied for different requirements, permitting the mounting of the drive above or at the side of the machine.



A wide range of open-belt spindle speeds can be secured by using two-speed motors, which will give eight different spindle speeds.

Another arrangement of this unit uses a single speed motor with the gear box output shaft coupled to the countershaft cone pulley. With this assembly, a 3-step cone would give twelve different spindle speeds.



Linderman Multi-Stage Hydraulic Diaphragms

A line of multi-stage diaphragms offered by Linderman Devices, Inc., 149 Broadway, New York, N. Y., consist of a number of super-imposed individual diaphragms, interconnected in such a manner that each diaphragm expands the same amount and all expansions add together to multiply the total amount of movement.

In operation, liquid or air pressure is admitted to the diaphragm, each stage of which expands an equal amount depending on the pressure. Only a slight amount of expansion is necessary for each stage, since total expansion is regulated by varying the number of stages incorporated in the design. This device is said to be particularly applicable where large total pressures are desired from relatively low unit pressures.

Diaphragms may be made from almost any material, including a wide range of steel and non-ferrous alloys. Steel diaphragms are treated for resistance to corrosion. No lubrication is required and no stuffing boxes are needed. Typical applications include brakes and clutches, holding fixtures, pressure regulators, damper adjustors, scales and lifting jacks. Range of movement is from 0.002 to 6 in. Up to 100 pulsations per min. are possible.

Mauser Stainless Vernier Calipers

George Scherr Co., 128 Lafayette St., New York, N. Y., is offering a universal Mauser vernier caliper made entirely of stainless steel. Formerly available only in chrome steel, this instrument is claimed to be unaffected by damp atmospheric conditions, acids and perspiration.

G. & G. Heavy-Duty Milling Cutters

Serrated, staggered tooth type channeling cutters, Fig. 1, having an improved taper dovetail wedge and serrated blade are offered by Goddard Co., 12280 Burt Road, Detroit, Mich. The blade locking construction has a serrated back blade and a taper dovetail wedge which allows

Fig. 1—Goddard & Goddard channeling cutters have improved taper dovetail wedges and serrated blades which permit increased grinding life

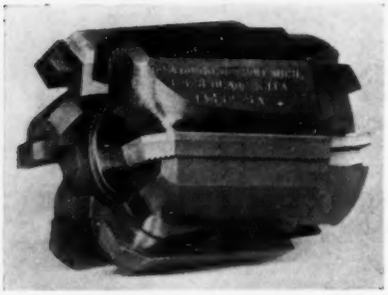


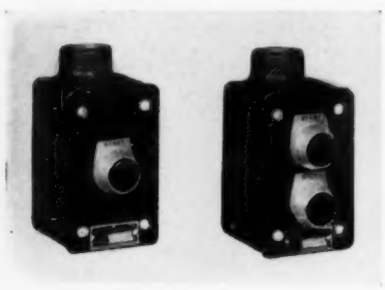
Fig. 2—Heavy-duty reamers offered by Goddard & Goddard have a tapered dovetail construction which locks the wedge from coming out radially

the blade to be adjusted radially until the bottoms of the blades are in line with the bottoms of the wedges, thereby giving a large amount of grinding life to the cutter. These cutters are claimed to be suitable for channeling or fluting locomotive side and main rods as well as other heavy cutting operations.

Designed for use on heavy reaming operations where large stock removal and heavy chip per tooth are encountered, the heavy-duty serrated-blade type reamers also announced, Fig. 2, have unevenly spaced blades to eliminate chatter and deep, well-rounded flutes which present no obstruction to the free-flow of chips or lubricant. Blades are supported back of the cutting edge and locked into place by means of wedges. Blades have radial serrations to match serrations in the reamer body. Only six sizes of blades are necessary to cover the entire range of reamers from $1\frac{1}{2}$ to 6 in. diameter. Both the channeling cutters and the reamers are being shown at the A.S.T.E. exhibition.

G. E. Oil-Proof Pushbutton Stations

A line of compact, standard-duty pushbutton stations designed to resist the deteriorating action of oil and dirt encountered in machine-tool applications has been announced by General Electric Co., Schenectady, N. Y. These stations are provided with a graphited packing ring between the button proper and the bushing or oil guard. This packing ring is claimed to prevent the seepage of oil or grease from the operators' hands into the button mechanism. The line includes flush-mounted, surface-mounted, momentary-contact, and selector switch units. Stations can be provided with the number of pushbuttons required for particular applications.

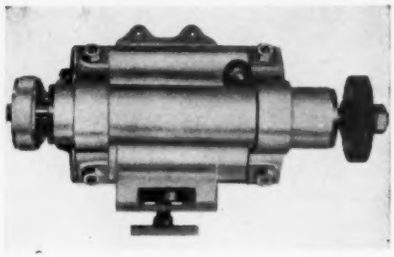


Hisey-Wolf Drill Grinders

Available either with 60 cycle a.c. or d.c. motors, these heavy-duty drill grinders offered by The Hisey-Wolf Machine Co., Cincinnati, Ohio, provide adjustment for grinding cutting clearance and point angle on straight or taper shank drills with two, three or four flutes. These machines also may be used for grinding flat or chucking drills or flat twisted drills and drills with oversize shanks. Point angle can be varied from 37 to 70 deg. Drills are supported in V-guides and no clamping or chucking is necessary. A screw fed is used to insure equal angles and lip length. These grinders are available either in 3 or 2 hp. capacity.

Themac Type J Toolpost Grinder

Internal and external grinding operations can be performed with the Type J toolpost grinder offered by The McGonegal Mfg. Co., 228 Orchard St., East Ruterford, N. J. This unit is equipped with a $\frac{1}{3}$ hp. universal motor having 6,000 r.p.m. full-load speed, and equipped for forced ventilation. Spindle assembly is detachable from the brackets, which can be swung around the motor frame. Distance from center of spindle to center



of T-slot bolt is $1\frac{5}{16}$ in. minimum and $2\frac{3}{32}$ in. maximum. Minimum distance from mounting base of grinder to center of spindle is $\frac{3}{8}$ in. For internal grinding, a 2-in. extension spindle is furnished. Complete unit weighs $8\frac{1}{2}$ lb. It is suitable for use on all types of engine lathes.

Taft-Peirce V-Blocks And Parallels

Two sizes of magnetic V-blocks and two sizes of magnetic parallels have been announced by the Taft-Peirce Mfg. Co., 32 Mechanic Ave., Woonsocket, R. I. The V-blocks are

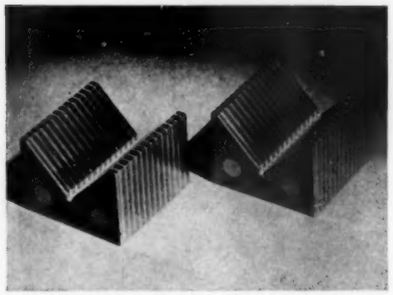
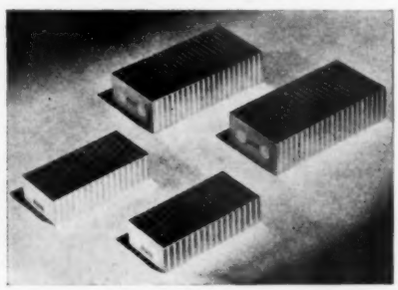


Fig. 1—Taft-Peirce magnetic V-blocks are made with alternate laminations of brass and steel

shown in Fig. 1 and the parallels in Fig. 2. These blocks and parallels are made with alternate laminations of brass and steel and can be used on all magnetic chuck face plates. Parallels are available in $\frac{3}{4} \times 1\frac{1}{2} \times 3$ in. and $1 \times 2 \times 4$ in. sizes. These units are being exhibited at the A.S.T.E. show in Detroit.

Fig. 2—Two sizes of magnetic parallels are available for use on any type of magnetic chuck face plate



"Dustfoe" Respirator

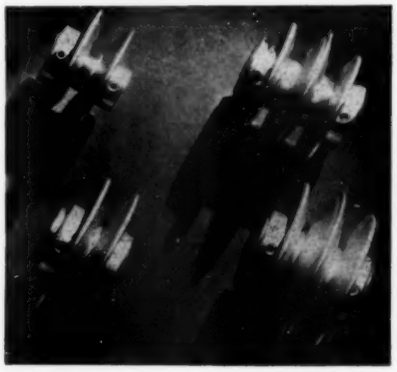
Weighing less than 3¼ oz., the "Dustfoe" respirator announced by Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa., is claimed to provide full protection with comfort under the most severe working conditions. This unit allows full vision in any direction and does not interfere with the wearing of goggles, spectacles, welding helmets or headcoverings of any type. All metal parts are made of aluminum and may be thoroughly sterilized at any time. The two- element filter will eliminate dust particles as small as one micron in size without noticeable breathing resistance. Cellulose filters are easily replaced.

Allis-Chalmers Adjustable Sheaves

A series of two-grooves adjustable pitch diameter "Texsteel" sheaves for speed variations up to 33 per cent have ben made available by Allis-Chalmers Mfg. Co., Milwaukee, Wis. This type of sheave is recommended for applications where the load does not exceed 3 hp. Three sizes of 2-3 in., 2.5-3.5 in., and 3.5-4 in. variations now are available.

Pitch diameters on these sheaves are changed by stopping the motor, relieving the belt tension, releasing the locking screw and turning the adjusting plate in or out to the desired pitch diameter. Sheaves are provided with a circular calculator which shows directly the speeds of the driven unit.

An intermediate diameter sheave has ben added to the single-groove adjustable pitch diameter series. These units also have a speed variation of 33 per cent for ratings up to 1½ hp.



"Photoswitch" Controls

Photo-electric control units designed expressly for industrial purposes are offered by Photoswitch, Inc., 21 Chestnut St., Chambridge, Mass. These units are claimed to be simple in design and construction, and to be efficient in operation. Control and light sources are furnished in weather-proof housings suitable for installation in any location. Units are equipped with a relay capable of operating any control or alarm up to 100 watts. A power relay may be used if control of heavier current is necessary.

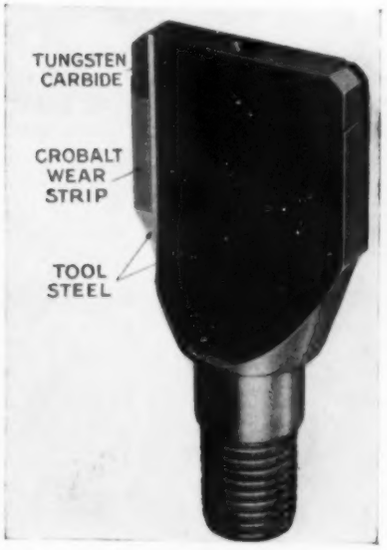
Eitzen Portable Brinell Meter

A portable Brinell meter offered by Louis C. Eitzen Co., 280 Broadway, New York, N. Y., simultaneously makes impressions in a reference bar and the material to be tested. This outfit consists of an instrument within which to nest a standard reference bar, which is supported in contact with a standard 10 mm. steel Brinell ball. The assembly then is placed in

position on the surface of the material to be tested and a plunger within the instrument is given a sharp blow with a hammer. The ball produces a simultaneous impression in the bar and in the surface of the material. Impression diameters then are compared and, by reference to a direct reading hardness table provided for the reference bar, the hardness of the material is noted. Six standard bars of carefully determined hardness and twelve standard steel balls are provided, as is a scale for measuring diameters to 0.1 mm.

"Crobalt" Non-Ferrous Wear-Resisting Alloy

"Crobalt," a cast material consisting in most part of cobalt, chromium and tungsten, has been made available by Michigan Tool Co., 7171 E. McNochols Road, Detroit, Mich., for wear-resisting purposes. Orginally announced as a cutting alloy (*AM*—Vol. 80, page 784), this material may be welded or brazed onto soft or



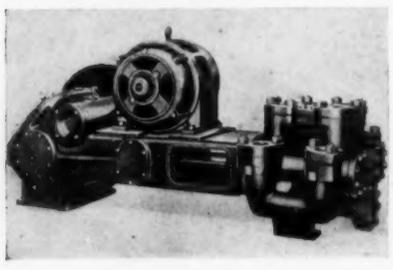
hard steel. It is highly resistant to heat, abrasion and corrosion. Among the possible applications for wear-resisting purposes for which "Crobalt" is recommended are boring bar pads, locating pins, lathe centers, chuck jaws, steady rests, plug gages, drill guides, locating pads and flaring tools. The flat boring tool shown is tipped with tungsten carbide and has "Crobalt" wear strips.

Stanley No. 362H Electric Drill

Designed for production work where a light weight drill is required, this No. 362H electric drill offered by Stanley Electric Tool Div., Stanley Works, New Britain, Conn., is available in three different speeds for drilling either in metal, wood or other materials. It is full ball bearing equipped and gears are of nickel steel. This model has an automatic pistol-type handle and an on-and-off switch, which is mounted in the rear end bell. Capacity is $\frac{3}{16}$ in., and over-all diameter of the housing is $2\frac{3}{4}$ in. Available without handle as No. 362 drill.

F.-M. Duplex Power Pumps

A line of duplex power pumps having eight-cover side-pot type fluid ends and inclosed, self-oiling power ends with herringbone gears and large roller bearings, has been announced by Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. The line comprises eight units which



are designed for pumping water, oil or other free-flowing liquids in quantities up to 187 g.p.m. at pressures up to 1,000 lb. per sq. in. They are available as basic pumps, Fig. 6184, with pulleys for belt drive, or as compact motor-driven units, Fig. 6185, with the motor mounted above the pump and connected to the power end by belt or gears.

Sherman "Corroflex" Flexible Wrapper

Corroflex cushion flexibile wrapper, offered by Sherman Papare Products Corp., Newton Upper Falls, Boston, Mass., combines a soft corrugated cushion surface with a heavy craft paper wrapper in one sheet. It is claimed to fold around corners

and over sharp edges with the ease of wrapping paper. Special adhesive is used to join the two sheets in such a manner that there is nothing to scratch polished surfaces. This wrapping material is supplied in rolls of 9 to 51 in. width and in sheets cut to suit requirements. Both rolls and sheets are furnished in light and heavy weights.

G. E. Dew-Point Potentiometer

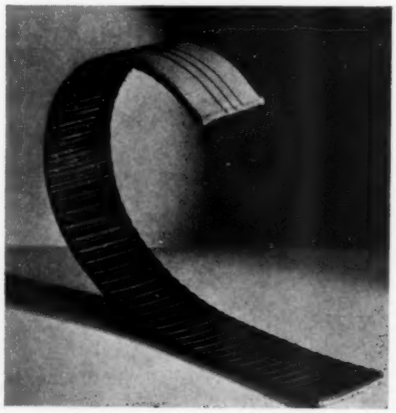
This portable dew-point potentiometer, offered by General Electric Co., Schenectady, N. Y., is arranged for use in determination of moisture content of atmospheres in industrial metal-heat-treating furnaces. Instrument consists of a polished, metallic mirror located in a small chamber in such a manner that it can be seen through a sight glass, means for cooling the mirror and reading its temperature. Gas to be tested is passed continuously through the chamber; and, as the temperature of the mirror is lowered by a jet of carbon dioxide

or some other gas from a storage tank directed against the back of the mirror, a spot of dew appears when the dew-point temperature of the gas is reached. Formation of dew at the center of mirror is very definite and is easily observed.

A light-gage thermocouple and a balancing circuit, with direct-reading meter, allow accurate reading of the mirror temperature at the instant that the dew appears. Conversion of the dew-point temperature of the gas being tested to weight of water vapor per cubic foot of gas or other convenient unit is an easy matter. Range of dew-point temperatures of the instrument is from 130 F. to minus 40 F.

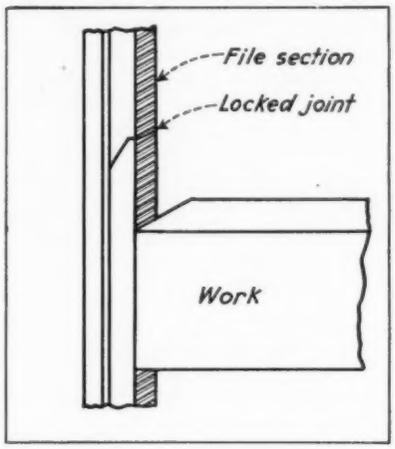
Sudbury "Chrome-tex" Soft-Leather Belting

"Chrome-tex" soft leather belting, offered by Sudbury Laboratory, Box 979, South Sudbury, Mass., is fabric-backed with a cross tread that is calimed to increase pulling power. This tread permits the escape of air which ordinarily piles up between the pulley and the belt. Softness of the leather also is claimed to improve pulling power. Use of the soft leather in the belting is made possible by the fabric backing.



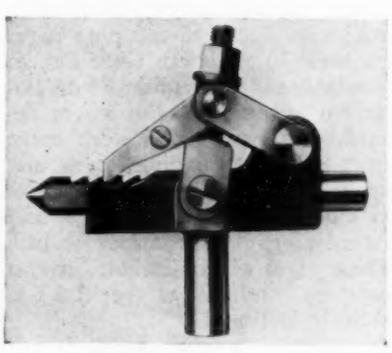
C.M.S. Improved Filing Band

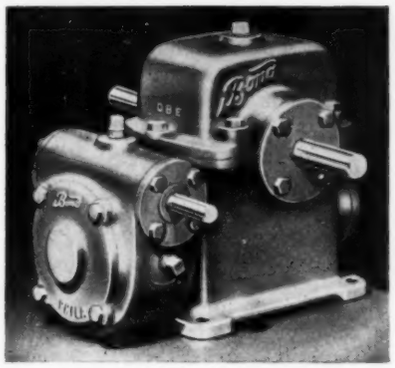
Made up of short file segments mounted on a flexible steel band, an improved continuous filing band offered by the Continental Machine Specialties, Inc., 1301 Washington Ave. South, Minneapolis, Minn., is claimed to lock each segment in line as it flows past the work. The effect created, it is claimed, is a steady flow of uninterrupted, constant cutting edge. The filing segment subject to pressure at any given moment, automatically lines up and locks the next segment on the band.



Howe "Clampco" Toggle Clamp

Furnished with various size shanks to fit holes in any type of planer, the "Clampco" toggle planer clamp announced by Howe Machinery Co., Inc., 30 Gregory Ave., Passaic, N. J., also is available with a self-locking T-head for use on machines having T-slotted tables. It can be had with a flat base for jig and fixture clamping. This clamp is designed for side clamping with a 3 deg. downward pressure bar for any stock. In use, the clamp shank is dropped into the hole of the planer and the plunger is pushed up to the work.





Bond Type B Speed Reducer

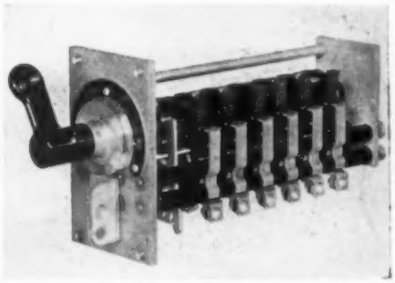
Designated as Type B double-reduction speed reducers, a series of units capable of handling inputs up to 2 hp. have been announced by Charles Bond Co., 617 Arch St., Philadelphia, Pa. Ratios as high as 4,000 to 1 are available in both horizontal and vertical types. Bronze worm gears and hardened steel worms are used in these units. All shafts are mounted in Timken antifriction bearings.

Dill "Pres-To" Spot Oiler

The Dill Mfg. Co., Cleveland, Ohio, offers the "Pres-To" oiler for precision lubrication of small machines and similar equipment. Simply pressing the steel point to the part to be oiled ejects approximately 1/10 of a drop of oil. If more oil is required, repeated pressing of the steel point to the spot will eject the desired amount of oil.

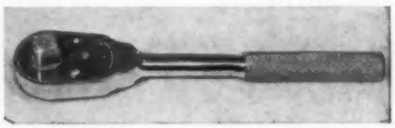
G.E. Multicircuit Rotary Cam Switch

Available for various multicircuit applications, a line of rotary cam switches offered by General Electric Co., Schenectady, N. Y., has been developed primarily for use in conjunction with machine-tool equipment. Switch consists of a series of cam bushings mounted on a shaft supported by two end plates. Assembly is held rigid by tie rods attached to the end plates. Steel-backed, silver-to-silver contacts are used, supports for these contacts being mounted on the tie rods which are insulated by high-dielectric strength tubes. Switch may be provided with a maximum of ten circuits and with as many as twelve positions in 360 deg. of rotation.



Bonney No. T35 Ratchet Wrench

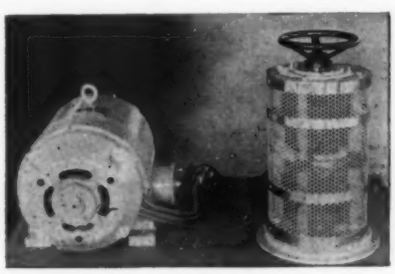
Suitable for use with $\frac{3}{8}$-in. square-drive sockets and attachments, the No. T35 reversible ratchet wrench offered by Bonney Forge & Tool Works, Allentown, Pa., is fully in-



closed to keep out dust, dirt, grit and grease. On the other side of the head is a $\frac{1}{4}$-in. square opening for use with $\frac{1}{4}$-in. adaptors on small compressors, motors, and shut-off valves. Knurled handle insures a firm grip.

C.-W. "Polyspeed" A.C. Motors

Fully continuous speed regulation, without rheostat loses, is claimed for the "Polyspeed" a.c. motors announced by the Crocker-Wheeler



Electric Mfg. Co., Ampere, N. J. These motors are claimed to provide constant torque throughout the entire speed range and can be operated by remote control if necessary. These three-phase a.c. motors have shunt motor characteristics with the speed practically independent of the load. They can be started across the line without damage.

This motor has a laminated stator core with a winding similar to that of a three-phase induction motor. Stator winding is connected directly to the power line and requires no adjustment. Laminated rotor core has a single winding similar to a normal d.c. armature winding and is connected to a commutator in the usual manner. Three brush studs are provided for each pair of poles, the brushes being set in a fixed position.

The speed regulator consists of two single-phase, induction-type voltage regulators placed in one frame with the two rotors mounted on a single shaft. Primary windings are located on the rotors and connected through flexible leads to the same three-phase source of power as the stator winding of the motor. The two secondary windings are placed on the stationary element and are connected to form a source of three-phase voltage which is applied to the motor brushes to provide the adjustable voltage required for regulation of motor speeds.

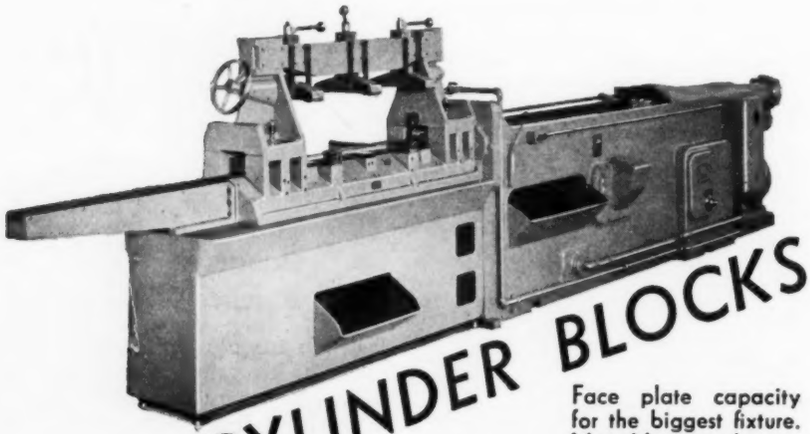
Speed control of the motor is wholly continuous. It is possible to obtain any speed between a minimum slightly above standstill to a maximum speed of approximately 1800 r.p.m., by turning the rotor of the speed regulator through an angle of 180 deg. A fan mounted on the motor shaft supplies sufficient air for cooling the motor under continuous operation, at any speed from 1800 r.p.m. down to 600 r.p.m. Due to the impaired effectiveness of this fan at lower speeds, it is possible to operate the motor at speds below 600 r.p.m. only for short periods of time without some external source of air for cooling. Direction of rotation can be reversed by interchanging any two of the line leads.

Magnus No. 55-P Industrial Cleaner

Magnus Chemical Co., Garwood, N. J., offers Magnus No. 55-P industrial cleaner for a wide range of cleaning operations. It is claimed to be suitable for washing painted and varnished surfaces, cleaning rest rooms and floors. It is claimed to deodize and disinfect the surfaces cleaned and to be mild in action.

Detroit "Crobalt" Thread Plug Gages

A line of thread plug gages made of wear-resisting "Crobalt" has been announced by Detroit Tap & Tool Co., 8432 Butler Ave., Detroit, Mich. An important advantage claimed for the use of this material for gages is its low thermal coefficient, reducing changes in gage size under varying temperatures to a minimum. These thread plug gages are made to American Gage Design standards and are furnished with aluminum hexagon handles where desired. Gages carried in stock range from a No. 8 machine screw size up to and including 1½ in. diameter in all listed standard sizes. Special thread plug gages also may be had. These gages will be included in this company's exhibit at the A.S.T.E. show in Detroit.



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TRADE PUBLICATIONS

BRONZE Catalog No. 380, offered by Johnson Bronze Co., New Castle, Pa., gives complete information on a wide range of bearing and sizes. This 64-page catalog lists 800 stock sizes of general purpose bearings, 350 sizes of bronze cored and solid bars, and more than 200 sizes of electric motor service bearings carried in stock.

CABLE Anaconda Wire and Cable Co., 25 Broadway, New York, N. Y., announces publication of a 16-page handbook discussing the application, construction and physical properties of "Parkway" cable together with information relating to current carrying capacities and cable jointing instructions.

CASTINGS Bulletin No. 136, offered by Shenango-Penn Mold Co., Dover, Ohio, discusses centrifugal castings and lists stock sizes of centrifugally cast bars and tubes.

CHUCKS Features of various types of drill chucks are discussed in Bulletin No. 10, offered by The Jacobs Mfg. Co., Hartford, Conn.

COOLANT PUMPS A bulletin offered by Narragansett Products Corp., 45 Baker St., Providence, R. I., discusses the features of Series 174 "Emby" ball-bearing coolant pumps.

D. C. MOTORS Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill., has published Bulletin No. 2260 in which are discussed the features of standard d.c. motors, available in sizes up to 200 hp.

EXPANSION BOLTS Catalog No. 29, offered by the U. S. Expansion Bolt Co., 75 Varick St., New York, N. Y., lists anchoring devices and kindred products.

FACE GEARS A four-page bulletin offered by the Fellows Gear Shaper Co., Springfield, Vt., discusses the face gear with reference to its design and application to angular and "offset" drives and cluches.

GRAPH SHEETS Graph sheets and coordinate papers and cloths are listed in a catalog-booklet published by Keuffel & Esser Co., Adams and Third Sts., Hoboken, N. J. This booklet illustrates the use of typical graph forms and describes a number of drawing accessories.

GEAR MEASURING Correct measurement of pitch diameters of either spur or helical gears is possible with the gear measuring blocks described in an 8-page bulletin published by Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill.

GRINDING Norton grinding wheels having particular application in foundries are discussed in a 6-page bulletin published by Norton Co., Worcester, Mass.

HASTELLOY Properties and typical applications of "Hastelloy" high-strength alloys for corrision resistance are discussed in a 36-page bulletin, Form No. 3361, published by Haynes Stellite Co., New York, N. Y.

JIGS Catalog No. 35, offered by the Cleveland Universal Jig Co., 13404 St. Clair Ave., Cleveland, Ohio, contains complete information on standard universal jig parts. Also on cam locks and angle plates.

LIGHTING Features of the "Millite" heavy-duty industrial lighting unit are described in a four-page bulletin, form No. F-8408, offered by Westinghouse Electric & Mfg. Co., Cleveland, Ohio.

METALLOGRAPHY Catalog No. E-225, offered by Bausch & Lomb Optical Co., Rochester, N. Y., describes metallographic equipment and accessories.

MILLING ATTACHMENTS "Speedmill" and "Midgetmill" attachments for high-speed milling, drilling and boring on standard milling machines are discussed in a 16-page bulletin offered by The Dalrae Tools Co., Syracuse Bldg., Syracuse, N. Y.

MOTORS Automatic-start induction polyphase a.c. motors are described in a 4-page bulletin, Form No. 1066, offered by Century Electric Co., St. Louis, Mo.

PHOTOELASTIC JOURNAL Published monthly by Barsol Publications, 55 W. 42nd St., New York, N. Y., the "Photoelastic Journal" will discuss the photoelastic method of stress analysis. Volume 1, No. 1 is dated January, 1938. Domestic subscriptions, $2 annually.

PIPE A 12-page catalog published by The Curtis & Curtis Co., Garden St., Bridgeport, Conn., discusses features of various standard pipe cutting and threading machines and tabulates specifications for each unit.

POSITIVE CHUCK A single-purpose chuck which provides a positive drive for straight-shank drills, taps and reamers, is described in an eight-page bulletin offered by The Jacobs Mfg. Co., Hartford, Conn. Standard tools for use in these chucks also are listed.

POTENTIOMETER Features of the "Pyromaster" line of recording potentiometers are discussed in a mailing folder now being distributed by The Bristol Co., Waterbury, Conn.

PUSHBUTTONS Type HD heavy-duty pushbuttons for use on a.c. and d.c. pilot circuits are listed and described in a combined catalog and price list Bulletin No. 15-010, announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REAMERS "Masterall' adjustable expansion reamers of both shell and shank types are described in a four-page bulletin, Form No. 1480, offered by Barber-Colman Co., Rockford, Ill. Operation required for adjusting these reamers are described in detail.

RELIEF Public Affairs Committee, Inc., 8 W. 40th St., New York, N. Y., announces publication of pamphlet No. 8, revised with the title "This Question on Relief". First issued a year and a half ago, this pamphlet has been completely rewritten to include 1937 figures and data. Price, 10 cents per copy.

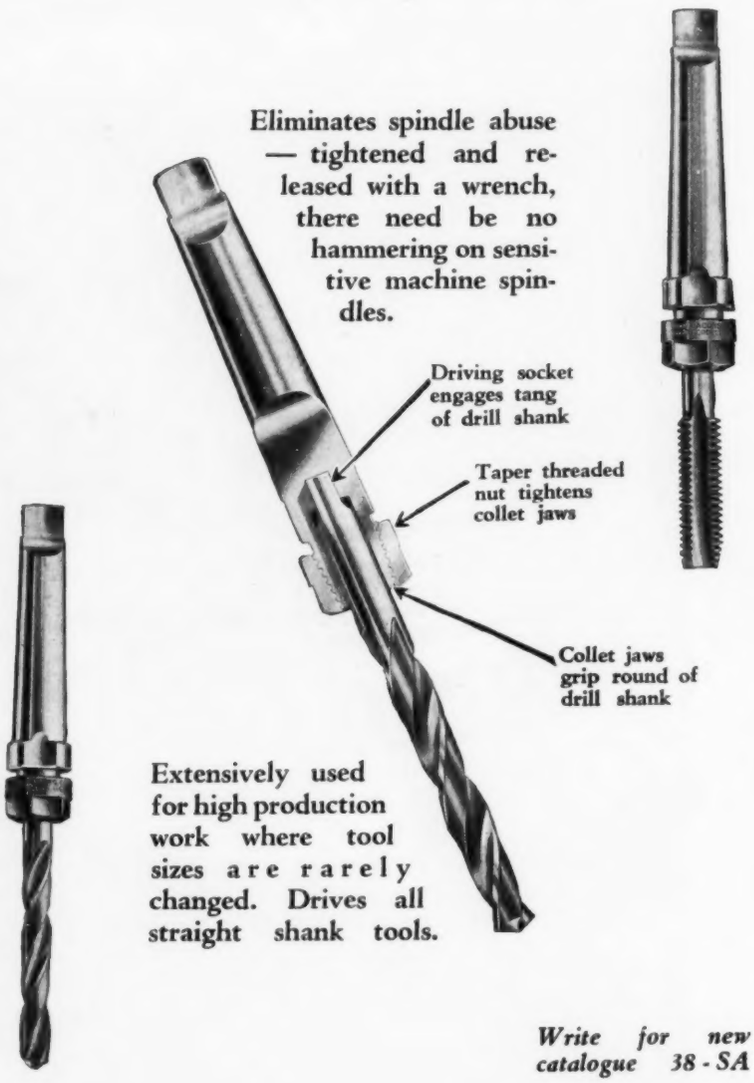
ROLLER BUSHINGS Roller bushings, with and without inner races, are listed in an eight-page bulletin offered by Orange Roller Bearing Co., Inc., 557 Main St., Orange, N. J.

SHEAR Bulletin No. 329, offered by Buffalo Forge Co., Buffalo, N. Y., describes the automatic shear for bolt and rivet stock.

SOCKET SCREWS Bristo socket screw products are described in Bulletin 835, recently published by the Bristol Co., Waterbury, Conn. Complete information is given on the wide range of sizes available and their applications in machine design and building.

SQUARING SHEARS Series SL power squaring shears are described in detail in a 12-page bulletin published by Niagara Machine & Tool Works, 637–697 Northland Ave., Buffalo, N. Y.

JACOBS SINGLE PURPOSE CHUCKS


Eliminates spindle abuse — tightened and released with a wrench, there need be no hammering on sensitive machine spindles.
Driving socket engages tang of drill shank
Taper threaded nut tightens collet jaws
Collet jaws grip round of drill shank
Extensively used for high production work where tool sizes are rarely changed. Drives all straight shank tools.

Write for new catalogue 38 - SA

The Jacobs Manufacturing Company

Hartford, Connecticut, U.S.A.

STARTERS Protection against explosion and corrosion with oil immersed motor starters is discussed in Bulletin No. 2118 offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STEAM JETS The Duriron Co., Dayton, Ohio, announces publication of a bulletin discussing steam jets, ejectors, tank outlets and spray nozzles. Capacity tables are given where applicable.

STEEL A 29-page bulletin entitled "Review of Iron and Steel Literature for 1937" prepared by E. H. McClelland, Technology Librarian, has been published by Carnegie Library of Pittsburgh. It consists of a classified list of the more important books, serials and trade publications offered during the year, with a few of earlier date not previously announced.

STOP NUTS Elastic Stop Nut Corp., 1001 Newark Ave., Elizabeth, N. J., has published a 46-page catalog discussing the features and applications of elastic stop nuts. Standard nuts and fittings are described in detail.

TRAINING Bulletin No. 16 prepared by the Federal Committee on Apprentice Training, U. S. Department of Labor, Division of Labor Standards, is a manual of procedure for establishing local joint plumbing apprenticeship standards. The title of this 16-page bulletin is "Putting National Plumbing Apprenticeship Standards to Work." Copies may be obtained from the Superintendent of Document, Washington, D. C. Price, 10 cents.

TRANSMISSION The JFS variable reducer transmission on which the speed can be regulated without interrupting operation is discussed in Catalog No. 68 published by Stephens-Adamson Mfg. Co., Aurora, Ill.

VALVES Typical uses for lift-plug valves are discussed in a folder offered by Homestead Valve Mfg. Co., Inc., Corapolis, Pa.

WELDING Bulletin No. 2123, offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., discusses the features of "Ignition" split-second control for resistance welding operations.

WESTINGHOUSE An 80-page book entitled "George Westinghouse Commemoration" and presenting the forum on the career and achievements of George Westinghouse conducted by the American Society of Mechanical Engineers in 1936 is offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., as long as the supply lasts.

NEW BOOKS

FUNDAMENTALS OF MACHINE DESIGN. *By C. A. Norman, Professor of Machine Design, Ohio State University; E. S. Ault, Professor of Machine Design, Purdue* University; *I. F. Zabolsky, Professor of Mechanical Engineering, University of Toledo. 486 pages. 6x9 in. Illustrated by line drawings and diagrams. Bound in cloth boards. Published by The Macmillan Company, 60 Fifth Ave., New York. Price* $4.25.

In this preface the authors say that is has been their aim to show basic principles by means of typical problems, and to bring out the necessity of modifying strictly theoretical design to accord with practical limitations. A chapter giving a brief

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Saving in the cost of die sets is one of the most expensive forms of tool room economy. Just a few more thousand pieces per regrinding more than pays for the extra value of the Precision Set. The cost of one production line tie-up, one die smashed would make up for a "precision appropriation" for an industrial lifetime.

Precision Pays. Shearing is the continual destroyer of die surfaces—offset it with the ±1/10,000" accuracy of Danly Precision Die Sets.

Precision Pays. Specify Danly Precision Die Sets and you have it.

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outline of manufacturing processes has been introduced to carry out this idea. There is also a chapter on the principles of strength of materials. The problems mentioned above are placed at the end of the respective chapters.

The best way to present the scope of this book is to list the chapter headings. They are as follows: Design Procedure and Standardization; Strength of Materials: Design Procedure and Standardization; Strength of Materials; Engineering Materials; Manufacturing Processes; Riveted Pressure Vessels and Riveted Joints; Welding; Screw Threads; Cylinders, Pistons, and Stuffing Boxes; Linkages; Cams and Ratchets; Shafts, Keys, and Permanent Couplings; Plain Bearings and Their Lubrication; Ball and Roller Bearings; Flywheels and High-Speed Rotors; Belts and Pulleys; Brakes and Clutches; Chains; Spur Gears; Helical Gears; Bevel Gears; Worm Gears; Methods of Forming and Finishing Gear Teeth; Wire Rope and Hoisting; Springs; Vibratory Stresses.

Although essentially a text book this volume should be a useful part of the machine designer's library.

INVENTIONS AND THEIR PROTECTION. *By George V. Woodling. 326 pages, 6x9 in. Indexed and illustrated. Clothboard binding. Published by The Penton Publishing Company, 1213 W. Third St., Cleveland, Ohio. Price,* $5.

Written to help the executive engineer and the designer in the protection and commercial development of their creations by giving them a practical knowledge of patents, this book also provides inventors and lawyers who are not patent specialists with a means of understanding how an invention is clothed with the legal protection necessary to enhance its economic value. Source material has been drawn from the author's experience, both as an engineer and later as a patent attorney.

Specific patent problems are discussed to bring out the major points. This book is carefully indexed and the main paragraphs are numbered for ready reference. Drawings and photographs are used to illustrate the book and considerable material is tabulated in such a manner as to aid the reader in understanding the basic requirements of patentability.

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PATENTS

February 1, 1938

Metal-Working Machinery

Forging Machine. William W. Criley, Cleveland, Ohio. Patent 2,106,830.

Machine Tool (Miller). Worthy J. F. Forward, Rochester, N. Y., assigned to Consolidated Machine Tool Corp., Rochester, N. Y. Patent 2,106,836.

Metalworking Machine (Forming). Frank A. Best, East Windsor, Ont., Can. Patent 2,106,866.

Apparatus for Manufacturing Expanded Metal. Leonard W. Cross, Wheeling, W. Va., assigned to the Consolidated Expanded Metal Corp., Wheeling, W. Va. Patent 2,106,967.

Pattern Controlled Milling Machine. Erwin G. Roehm, Norwood, Ohio, assigned to the Cincinnati Milling Machine Co., Cincinnati, Ohio. Patent 2,107,063.

Electric Welding Apparatus. Ralph A. Terrell, Chicago, Ill., assigned to Borg-Warner Corp., Chicago, Ill. Patent 2,107,093.

Jigsaw. John E. Boice, Toledo, Ohio. Patent 2,107,174.

Parts and Mechanisms

Conveyor Mechanism. Robert H. Gordon, Detroit, Mich., assigned to Parker Rust Proof Co., Detroit, Mich. Patent 2,106,706.

Power Transmission Means. Allan J. Chantry, United States Navy. Patent 2,106,720.

Speed Change Mechanism. Keith F. Gallimore, Fond du Lac, Wis., assigned

to Giddings & Lewis Machine Tool Co. Fond du Lar, Wis. Patent 2,106,731.

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Tool Head for Milling Machines. Worthy J. F. Forward, Rochester, N. Y., assigned to Consolidated Machine Tool Corp., Rochester, N. Y. Patent 2,106,835.

Inclining Device for Inclinable Punch Presses. Frederic Orton, Buffalo, N. Y., assigned to Niagara Machine & Tool Works, Buffalo, N. Y. Patent 2,106,917.

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Variable Speed Belt Drive. Ferdinand Nigra, San Francisco, Calif., assigned to Nigra Duplicator Co., San Francisco, Calif. Patent 2,106,930.

Improved Nut. Anthony George Maldon Michell, Melbourne, Australia. Patent 2,106,984.

Bushing Locating and Rotating Means. Ottis R. Briney, Pontiac, Mich. Patent 2,107,051.

Shaft Coupling. Werner Fleury, Arbon, Switzerland, assigned to Societe Anonyme Adolphe Saurer, Arbon, Switzerland. Patent 2,107,070.

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Art of Machine Control. Warren Dunham Foster, Washington Township, Bergen Co., N. J., assigned to Kinatome Patents Corp., New York, N. Y., Patent 2,106,730.

Plastic Extrusion Molding Press. Victor S. Shaw, Cardington, Ohio, assigned to the Hydraulic Press Corp., Inc., Wilmington, Del. Patent 2,107,190.

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Bushing Remover. Joseph F. Herbert, Audubon, N. J. Patent 2,106,741.

Method and Device for Measuring. Rudolph S. Brescka, Cranford, and Edward J. Meagher, Newark, N. J., assigned to Western Electric Co., Inc., New York, N. Y. Patent 2,106,790.

Portable Elevator. Henry Lutcher Sinclair, Houston, Tex., assigned to Houston Compress Co. Patent 2,106,878.

Drill (Portable). John E. Torbert, Jr., National City, Calif. Patent 2,106,937.

Distortion Check for Welding Apparatus. Laurence C. Powell, Portsmouth, Va. Patent 2,106,987.

Drawing Board and the Like. Alfred H. Young, West Hartford, Conn. Patent 2,107,049.

Blast Gun (Sand). Clarence B. Pletcher, St. Joseph, Mich. Patent 2,107,084.

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Micrometer Gauge. William J. Summers, Chicago, Ill. Patent 2,107,222.

Wrench. Joseph R. Bittner, Philadelphia, Pa., assigned to Griffith Tool Works, Philadelphia, Pa. Patent 2,107,231.

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Centrifugal Casting Machine. Adolph G. Anderson and James I. Kibbe, Muskegon, Mich., assigned to Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich. Patent 2,107,322.

Shape Cutting Machine (Gas). Otto A. Scholtz, Waterloo, Iowa. Patent 2,107,396.

Plural Gear Shaping Machine. Edward W. Miller, Springfield, Vt., assigned to the Fellows Gear Shaper Co., Springfield, Vt. Patent 2,107,543.

Cut-Off Machine (Abrasive). Ralph D. Gardner, Rockford, Ill., assigned to Whitney Metal Tool Co., Rockford, Ill. Patent 2,107,566.

Shears. Samuel P. Moyer and Paul H. Long, Middletown, Ohio, assigned to the American Rolling Mill Co., Middletown, Ohio. Patent 2,107,577.

Automatic Shaping Machine. Rudolph Onsrud, Chicago, Ill., assigned to Onsrud Machine Works, Inc., Chicago, Ill. Patent 2,107,578.

Apparatus for Forming Screw-Threaded Necks. Jakob Dichter, Berlin-Schoneberg, Germany. Patent 2,107,979.

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Variable Speed Transmission. Albert Breakenridge Knight, Fairmont, W. Va. Patent 2,107,483.

Universal Joint. Joseph E. Padgett, Toledo, Ohio. Patent 2,107,497.

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Hydraulic Mechanism. Elmer McCormick, Milford D. Stewart, and Wayne H. Worthington, Waterloo, Iowa, assigned to John Deere Tractor Co., Waterloo, Iowa. Patent 2,107,760.

Abrading Apparatus. Walter L. Keefer, Hagerstown, Md., assigned to Pangborn Corp., Hagerstown. Patent 2,108,005 and 2,108,006.

Hydraulic Operation and Control of Machine Tools. Robert D. Shaw, Brooklyn, N. Y., assigned to Niles-Bement-Pond Co., Hartford, Conn. Patent 2,108,625.

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Method of Forming Expanded Metal. Herbert K. Baker, Kokomo, Ind. Patent 2,107,278.

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GEARS AND SPEED REDUCERS

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Treatment of Steel. Morris G. Fowler and Lyle M. Barker, Clarkdale, Ariz., assigned to Phelps Dodge Corp., New York, N. Y. Patent 2,107,328.

Method of and Mechanism for Producing Gears. Ernest Wildhaber, Irondequoit, N. Y., assigned to Gleason Works, Rochester, N. Y. Patent 2,107,460.

Method and Apparatus for Making Slide Fasteners. Frank P. Miller and Lewis Skeel, Meadville, Pa., assigned to Joy Fastener Co., Franklin, Pa. Patent 2,108,007.

Method of Honing. Kirke W. Conner, Detroit, Mich., assigned to Micromatic Hone Corp., Michigan. Patent 2,108,029.

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Gaging Fixture. Herman W. Zimmerman, Chicago, Ill., assigned to Automotive Maintenance Machinery Co., North Chicago, Ill. Patent 2,107,558.

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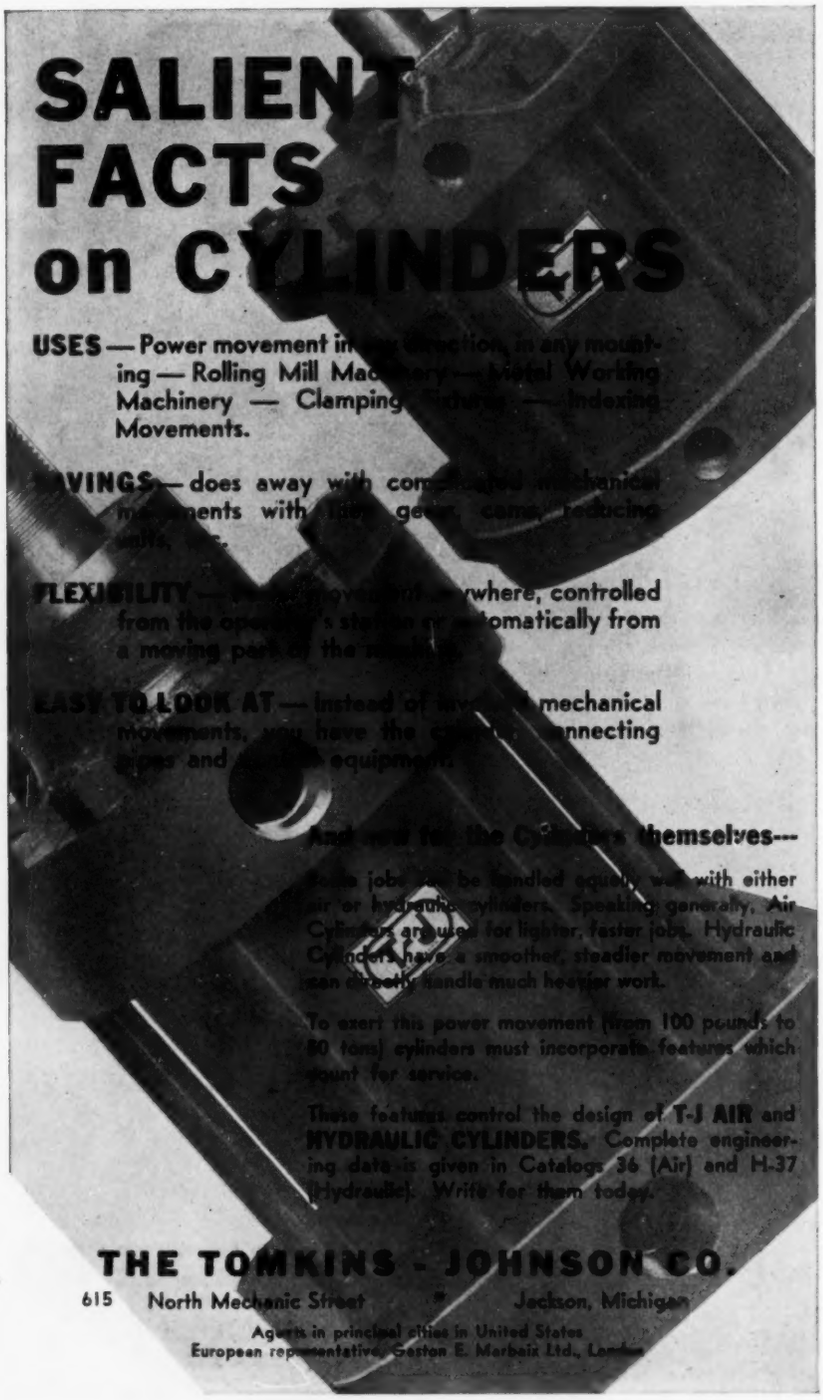
60 YEARS AGO

The following items appeared in *American Machinist* dated March, 1878:

The Pratt & Whitney Mutual Benefit Association was organized December 10, 1873, and has ever since been in successful operation. The officers consist of president, vice-president, secretary and treasurer, and there are nine directors including the four officers. The association has paid out in benefits $3,341.85 at the rate of $10 a week.

If your hands are covered with oil that smells bad you can take it off by rubbing them well with dry mustard and wash them with cold water.

To Harden Cast Iron—Take one-half pint oil vitreol, one peck common salt, one-half pound saltpeter, two pounds alum, one-quarter pound prussiate potash, one-quarter pound cyanide potash; dissolve in ten gallons soft water. Be sure that all the articles are dissolved. Heat the iron to a cherry red and dip it in the solution. If the article needs to be very hard heat and dip the second and even the third time.


SALIENT FACTS on CYLINDERS
USES — Power movement in any direction, in any mounting — Rolling Mill Machinery — Metal Working Machinery — Clamping Fixtures — Indexing Movements.
SAVINGS — does away with complicated mechanical movements with their gears, cams, reducing units, etc.
FLEXIBILITY — Power movement anywhere, controlled from the operator's station or automatically from a moving part of the machine.
EASY TO LOOK AT — Instead of unsightly mechanical movements, you have the cylinders connecting pipes and valves.
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Some jobs can be handled equally well with either air or hydraulic cylinders. Speaking generally, Air Cylinders are used for lighter, faster jobs. Hydraulic Cylinders have a smoother, steadier movement and can exactly handle much heavier work.
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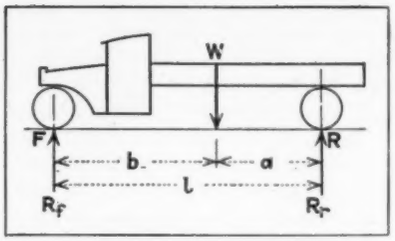
Long Truck Weighed on Narrow Scales

ROBERT TWEEDSIDE

The factory has a standing rule that all loaded motor trucks leaving it should cross the stockroom scales to have their loads weighed. One day as Bill Wrench, the master mechanic, was crossing the yard he was hailed by the scalesman who pointed to a strange 5-ton truck straddling the scales with both front and rear wheels off the platform. "How can I weigh a truck with a wheel base like that on such a narrow platform?" he asked. "We'll have to get new scales, for the trucks are getting longer."

Bill looked wise. "Why not do the best you can?" he replied. "Weigh each axle load separately and add them together." The scalesman was skeptical, but did as he was told. Bill himself had some misgivings. As a boy he had to pass a little coal yard on his way to school and had often noticed that the horse-drawn wagons were weighed with first the front and then the rear wheels on the tiny platform of the scales. In his office he tried to prove the matter to his own satisfaction, but what with his hands being dirty or having forgotten some of his algebra, he couldn't just get the figures to show it, so he called in John Lines the draftsman and put the case before him.

"Of course you're right, Bill," said Lines. "Just watch me. If I stand with my feet apart and my



If the loads on the front and rear wheels of a truck are weighed separately, the sum of the weights will equal the total load

body evenly balanced, each foot will bear one-half of my weight. But if, without shifting my feet, I gradually lean to the left, I can feel my left foot taking more of my weight and my right foot taking less. I haven't changed my weight, so the pressure on my right and left feet added together must be equal to my total weight. Going the limit, when my left foot carries all my weight my right foot carries none."

"That's reasonable enough, John, but I'd like it in figures."

"All right, here are the mathematics of the problem," said John, making a sketch.

Let W = Total load or resultant downword pressure which acts through the center of gravity.

R_f and R_r = Reactions or upward pressures under front and rear pairs of wheels respectively.

l = Wheel base or center distance between front and rear wheels.

a and b = Distances from center of gravity to rear and front points of support respectively.

Taking moments about the front point of support F, the clockwise moments equal the counterclockwise, for the truck is in equilibrium.

Then: $R_r \times l = W \times b \qquad R_r = Wb$

Similarly: Taking moments about the rear point of support R.

$$R_f \times l = W \times a \qquad R_f = \frac{Wa}{l}$$

Adding:

$$R_f + R_r = \frac{Wa}{l} + \frac{Wb}{l} = \frac{W(a+b)}{l} = \frac{Wl}{l} = W$$

That is, the sum of the wheel pressures or axle loads equals the total weight no matter where the center of gravity may be. In order to have exactly similar conditions and to lessen the possible error in old scales, however, the wheels should be located in the same position each time, preferably at the center of the platform.

A Father Writes to His Son

ROGER C. DICKEY
The International Paper Box Machine Company

Dear Son:

So you want to know what I think of the machinist's trade, son! Well, I can honestly say I think its the finest trade in the world and it makes me feel mighty good to know that you have a chance to become an apprentice in Robinson's Machine Shop and that you are seriously thinking of taking it.

You may want to know why I think it's a good trade, and I'll tell you. There are many things to think of when a young fellow just graduated from high school considers the future. A few of these are the possibility of advancement, the stability of the trade, the oppor-

There was no precision — as we know it now — in those days when America traveled by horse and buggy. But America was "waked up" and "Miked up" since then. Today measurements of a tenth — or even a half a tenth of a thousandth of an inch are common practice. And America is at the head of the world's industrial parade.

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tunity for service and remuneration.

Let's consider the possibility of advancement. Unfortunately your dad cannot afford to send you to college just now, but possibly in two years things may be better. In the meantime, if you work and save your money, it may be that we can arrange for you to go to college. You could work summers and thus help out. If this should be the case, your shop training would be indispensable to you not only while you are going to school but after you graduate. You should be able to climb rapidly to the position of machine designer or factory superintendent.

If conditions do not develop favorably and you do not have an opportunity to go to college, you will be on your way to becoming a first class machinist. And even as a machinist there are possibilities for a better job. If you are a good level-headed mechanic, opportunities will come to you, and it will be up to you to make the most of them.

The machinist's trade is the most stable trade there is because we are machine conscious and will continue to be for hundreds of years to come. Each week the patent office publishes a many-paged booklet listing the patents granted. It is almost beyond comprehension the number of new machines and new products that are developed. Someone must build the machines and the patented products will, for the most part, be manufactured on machines.

As long as we depend on machines to lift our civilization and make our lives better, just so long will we need good machinists.

More and more are we realizing that we do not live unto ourselves alone. To be happy we must serve mankind. A machinist does not serve mankind in any spectacular way but day after day he is slowly building and creating machines which make man's work lighter. There should be considerable satisfaction in such service. It is my hope that you can go to college and learn the technicalities of mechanics. You should then be able to coordinate your shop experience with your college training and develop machines which will serve mankind.

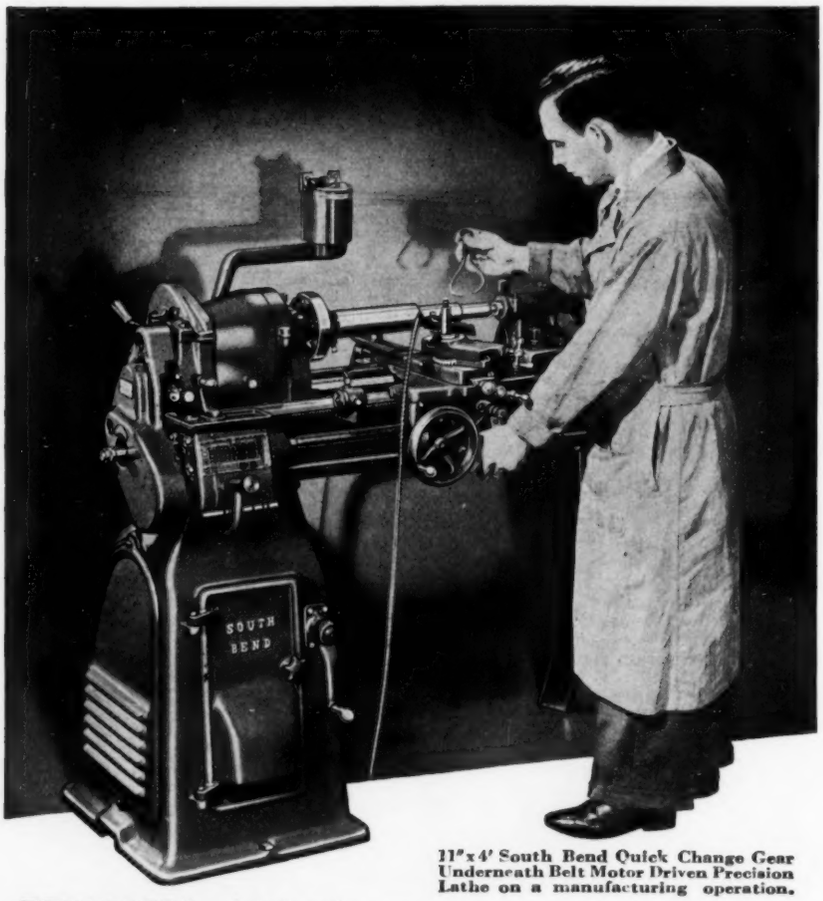
As far as remuneration goes, a machinist is assured of the necessities of life and a little bit more. This is more than can be said for some trades. If you are a good machinist you will be assured of work the year around which would not be the case if you chose a building trade which depends on weather conditions and is subject to frequent building slumps. A pay check each week is truly something to be desired.

But do not think, son, that the machinist's trade is easy to master. If you live to be a hundred and work every day, you'll not know all there is to know about machines and how to build them. But in a few short years of faithful application you can graduate from the apprenticeship class into a full-fledged machinist.

You've got to use your head at all times. Recently I was talking to a retired machinist about his sons. He said: "Ed's a machinist now; but Joe didn't have brains enough to be a machinist so he's a lawyer."

So son, if you want to make the most of your life you will make no mistake in serving an apprenticeship in a machine shop. It will be your one way ticket toward a better life and better living.

Sincerely,
Your Dad.



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